

At last! A powerful, quiet trail bike

**THE SPY PLANE
WE DON'T TALK
ABOUT** Page 80

Popular Mechanics

APRIL 1972
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Begins on page 110

What owners say about Detroit's
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Road racing's hottest drivers

Page 75

Denny Hulme
in McLaren M-19





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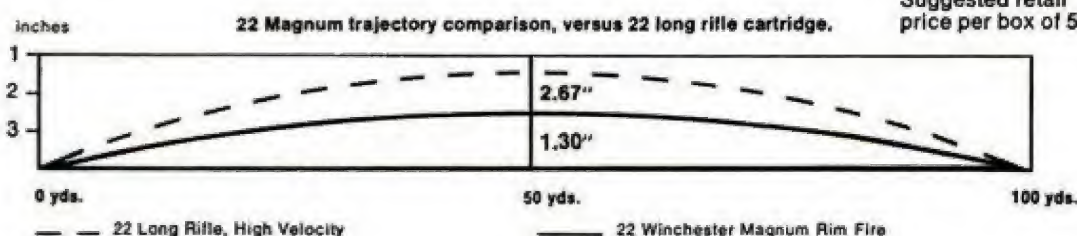
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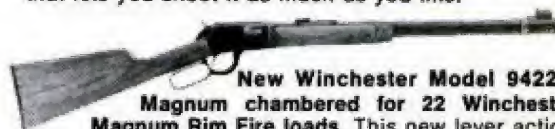
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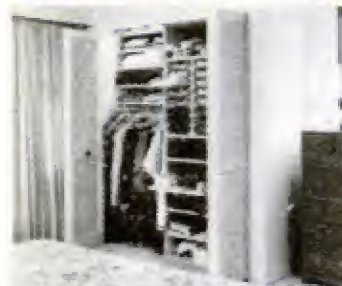
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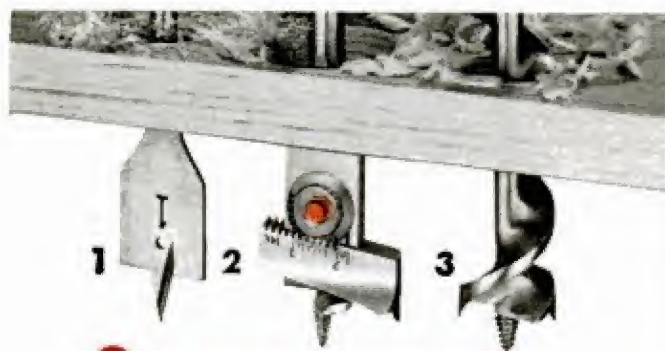
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LETTERS TO THE EDITOR

Pioneer in tooth implants

The editors of Popular Mechanics sincerely regret that the article, Plastic teeth that 'take root' (page 82, Feb. PM), highly condensed for reasons of space, did not give adequate coverage to the pioneering work of Milton Hodosh, DMD, of the Tufts University School of Dental Medicine. As early as 1959 he published a scientific paper reporting results of the implantation of plastic teeth in four patients. He is the originator of the polymer tooth concept, and his research has been reported in numerous scientific papers.

Working with Gerald Shklar, DDS, of the Tufts University School of Dental Medicine, and Morris Povar, DVM, of Brown University, Dr. Hodosh has greatly advanced the materials technology of tooth implants. He has developed a plastic-bone mixture with a chemical composition similar to that of the natural bony substance that holds a tooth in place. By adding a foaming agent to the mixture, the researchers have made the implant's root surface more porous, permitting earlier attachment and penetration by connective tissue fibers. Their experiments also indicate that plastic implants can be used to provide increased support for extended bridgework.

In a further extension of their work, the researchers say that implants can be constructed in such a way that medications can be "sealed into" them. The medication would be absorbed very slowly by the patient's system. This method of drug therapy could be used for the administration of hormones, anticonvulsive agents, contraceptives, steroids, etc., and might well overshadow the use of transplants as replacements.

Dr. Hodosh's pioneering work has done much to advance the science of dental medicine—and we are glad to set the record straight.

No longer a carbon copy

The two-story "Box" on page 122 of *Why live in a carbon copy?* (page 118, Sept. '63 PM) was almost a copy of my house. Although my remodeling isn't quite like your "Junior Mansion," we are very pleased with the results.

We boxed in the old exposed eaves, removed the porch, installed a new window and door, added shutters, changed the corner facing boards, added a railed and

(Please turn to page 8)

"Look who's smiling now!"

Sometimes a man sets his ambitions high enough to make skeptics smile. But how often he gets the last laugh! "At the time I started studying with LaSalle, I was working as a factory clerk. Before completing the course I was transferred to cost accounting and my salary was increased by \$1800. Now, having completed the course, I'm in charge of the department and headed for the five figure bracket. LaSalle's course helped me pull myself out of a boring and ill-paid job into a position of almost unlimited opportunity."

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LETTERS

(Continued from page 6)



carpeted stoop and applied a little paint. Actual expense was about \$700, many hours of sweat and some few tears! I take some pride in the undertaking as I did it all myself with the help of my family only. Thanks for the inspiration!

DIXFIELD, ME.

ROLAND M. DENNETT

Your letter arrived just in time for inclusion in an issue in which we're showing how to improve another series of "carbon-copy" homes. See page 134.

Fins helped the Dodges

In the January *Letters*, William Kirlin lists auto fins among "valueless changes." But having owned two 1957 Dodges and a 1959 Dodge, I found that the fins were very practical at highway speeds. They made quite a difference in handling and roadability of these cars at 70 mph.

WADENA, MINN.

MERVIN SPROULS

One province too many

In the February *All Outdoors* (page 52), I came across what an American might regard as a small error but to a Canadian it is another irritating example of American ignorance of Canada and Canadians.

(Please turn to page 10)

**The Great In Between Machine.
For riders too big for mini's,
but not ready for the heavyweights.
Light, lean and hungry:
the Yamaha 100cc LT-2 Enduro.
With new exclusive Torque Induction.**

Not too big. Not too small. The all-new LT-2 Enduro packs a lot more performance than any other 100cc production trail bike on the market. And, it's equally at home on the road, with all the stability, ease-of-handling and reliability Yamaha Enduros are famous for.

Up front, you get a set of Enduro forks that will smooth out the roughest of winding trails. Then there's the new steel alloy frame for lighter weight and greater strength. Autolube Oil Injection that mixes your gas and oil automatically. Extra-large, extra-dependable dustproof/waterproof brakes. Deep-tread tires for great traction. A simple, strong 5-speed constant-mesh gearbox. Turn signals front and rear. And, of course, the exclusive Yamaha Torque Induction.

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The best thing that's happened to off-road riding since we introduced the very first dual-purpose Enduro back in 1967. Torque Induction is a high-quality stainless steel reed-valve system that delivers greater low and mid-range torque; more precise intake and exhaust; and greater fuel economy. Put it together with the most dependable 2-stroke, 100cc engine off the road, and you've got a little green bundle of dynamite charged with excitement.

It's a better machine.

All in all, the LT-2 Enduro is more trail bike for the money. The same kind of value you'll find in all the great Enduros for '72. See your nearby Yamaha dealer. He's got the in-between machine that has earned the right to be called, "great."



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LETTERS

(Continued from page 8)

The passage is: "Winchester Hunter's Handbook, 1972 has 100 pages of complete state and provincial game regulations, seasons and prospects for all 50 states and 11 Canadian provinces . . ."

At last count, Canada still consisted of 10 provinces and 2 territories.

VANCOUVER, B.C.

G. K. HYNEK

No center door for dog

In your February *Letters* you show a picture of a doghouse with the name *Blooper* over its door. How aptly named it is, for it is truly a blooper.

No doghouse should have a door in its center. It should be to one side. Reason? Give a dog greater space to turn around and snuggle up away from the wind. I'd also like to see a burlap curtain hung over the entrance.

ROYALTON, ILL.

C. J. MALCOLM-SMITH

One and only

In your excellent article, *Ignition timing simplified* (page 116, Feb. PM), you state that there are a number of manufacturers who produce a combination timing light, tachometer and/or dwell meter in a single case. To our knowledge, we at Orbit Laboratories are the only ones who have a portable tach, dwell and timing light instrument on the market (our 300X).

ORBIT LABORATORIES JOE SALZBURG
NEW YORK V.P. AND TREASURER

Backward space center

After visiting the Alabama Space and Rocket Center at Huntsville, we were surprised to see the whole center had been turned around in your January issue (*Space and rocket exhibit*, page 97). The picture is printed backwards.

VAN, PA.

MRS. WAYNE CHAMBERS

Yup, it is. And we checked the original photo sent to us by the center. It's backwards, too.

B-1: obsolete in the '80s?

I must take exception to several "facts" in *B-1: a flexible flyer for the '80s* (page 50D, Jan. PM). First, the R&D program "reportedly costing a bit over \$1-billion" is costing \$2.6-billion, exclusive of some of the weapons systems. Second, before it can be "loaded with the latest in electronic hardware," the hardware must be developed. Third, the range is 6000 miles, not

(Please turn to page 12)

**When it comes to toughness,
we can show you a thing or two.**



The Toyota Land Cruiser could probably sell itself sitting at a curb. It looks massive, almost indestructible. The solid steel front bumper. The skid plates underneath. The clamps that hold the hood secure. The nuts. The bolts. The cotter pins.

At a glance, you can see how it earned its reputation.

And though the Toyota Half-Ton is designed differently to do a different job, that tough Toyota quality is there, as well.

Despite its small, practical size, the Toyota Half-Ton has the same 1000-pound load capacity as bigger half-tons. And that load is supported by a rear axle with a capacity of 2390 pounds (G.A.W.R.).

Our engine is not the most powerful on the market. But it offers a lot of displacement for

the size of the truck. 1968 cc's, to be exact. So it has the ability to get a full load moving quickly. And efficiently.

Underneath the radiator, attached to the frame, is a steel splash pan designed to protect the fan and radiator from rocks and stones and other road hazards.

The bed connects to the frame at eight different points. The throttle cable is covered to help keep it lubricated and free from dust. There's a large 12 volt/60 amp. battery for campers and others who might be running a lot of accessories.

In short, our pickup is designed to withstand punishment.

And that's why the Toyota Half-Ton and the Toyota Land Cruiser have more in common than a first name.

For your nearest Toyota dealer, call 800-243-6000 toll free. (In Connecticut, 1-800-882-6500.)

LETTERS

(Continued from page 10)

10,000 (that's half as far as a B-52). If it flew at top speed for 6000 miles it would arrive in four hours, the time it would take for eight salvos of missiles. Fourth, by 1980, low flight will be matched by "look-down" radar systems that will render the plane obsolete. Fifth, the Air Force has dropped the plane's supersonic high-altitude flight.

HERSHEY, PA.

JAMES D. GRAY

Total cost of the R&D on the B-1 is \$2.6-billion. The airframe is costing "a bit over \$1-billion"; the other \$1.6-billion is for avionics, engines and flight testing.

As for range, a North American Rockwell spokesman says it's classified, but is definitely intercontinental. In 1961 the Strategic Air Command did fly a B-52 12,000 miles at high-altitude cruise (the area of optimum range for any aircraft). However, today's strategic bomber mission must be carried out at extremely low altitudes when enemy airspace is reached. The B-1's range performance at low altitude far exceeds that of the B-52. (With aerial refueling, the B-1's range is limited by the crew's endurance; missions up to 36 hours are planned.)

As for nuclear-tipped missile salvos, ICBMs are not accurate enough to hit most military targets, thus would kill millions of civilians. The B-1, on the other hand, armed with highly accurate short-range attack missiles, can pinpoint and destroy weapons of war.

The North American Rockwell spokesman states further that U.S. intelligence sources say it is highly unlikely that "look-down" radar will be developed by 1980. And, finally, the B-1 has definitely been designed to fly faster than Mach 2 at a high altitude, he says.

Make those drawers fit

The drawing on page 125 of the February issue (*A modelmaker's workshop*, page 124) has a $\frac{3}{4}$ x $\frac{3}{4}$ x 30-inch top rail spanning the front that my original cabinet did not have. Now the drawers won't fit when readers copy my cabinet. SOMERVILLE, N.J.

RUDY KOUHOUP

We added the rail for strength—but did forget to compensate in drawer sizes. To get the drawers to fit, make the drawer schedule on page 126 read thus:

	A	B
Top drawer	1-7/16"	1-1/16"
Second drawer	2-7/16"	2-1/16"
Bottom drawers	2-13/16"	2-7/16"

These measurements give 5/16-inch clearance overall between all seven drawer fronts.

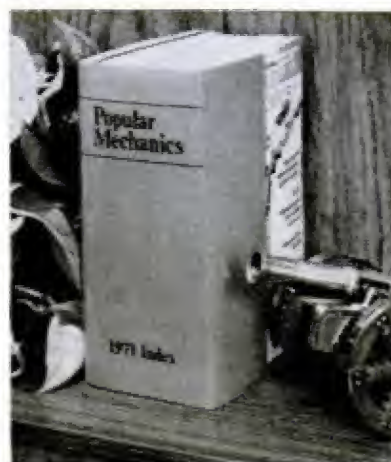
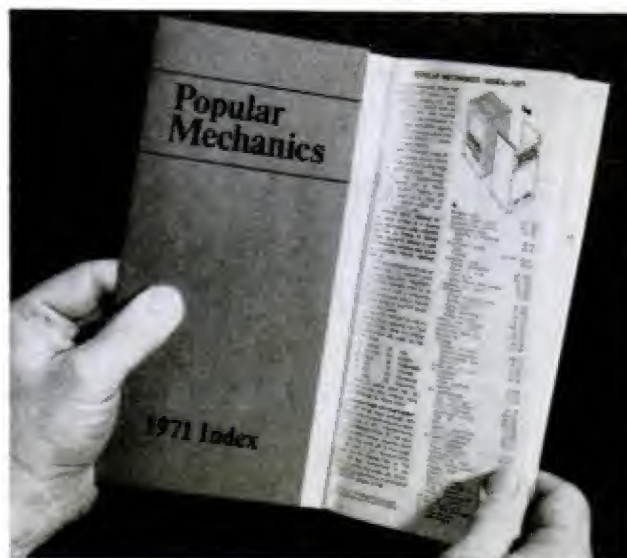
Index is a 'fine idea'

I just received my 1971 PM Index and am writing to let you know how pleased I am with this fine idea and quality product. Please continue to produce this index in the future.

NATICK, MASS.

GEORGE E. LINSKY

We're already working on the 1972 Index. Meanwhile, the 1971 Index is still



available for \$1.49 from Popular Mechanics, Dept. JL, 224 West 57th St., New York, N.Y. 10019. In all, it contains more than 5000 entries, giving references and cross-references for

every article published in PM in 1971. It comes in a handsome, heavy binder that keeps the 12 issues together on your bookshelf.

Will a footstool do?

A colonial chair you can build for \$53 (page 144, Dec. PM) is an excellent project. Would it be possible in the near future to publish an article on a colonial sofa to go with the chair?

GOBLES, MICH.

CORWIN RIFE

We don't have plans for a sofa yet, but we will be publishing a matching footstool in the summer—probably July. ★★★

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Photo Hints



Spill catcher for darkroom trays

A plastic boot tray, used to protect entryway floors from messy overshoes, is perfect for catching splashes of processing chemicals, saving your counter from spills.

—Walter E. Burton, Akron, Ohio



Handy storage case for filters

Delicate filters can be safely stored in an eyeglass case. Make padded dividers from cardboard faced with thin foam plastic.—Arthur L. Ramos, San Anselmo, Calif.



Mini-reel for developing small film

If your camera collection includes a sub-miniature pocket type using 16-mm film, you may find developing difficult without a special tank to handle such narrow strips in short lengths. An easy compromise is to make your own mini-reel to fit in a standard 35-mm tank. The one above is $3\frac{3}{8}$ inches in diameter and holds 34 inches of 16-mm film. Cut the end discs from Bakelite or similar material and the rods from $\frac{1}{8}$ -inch noncorroding wire. A short length of brass tubing or wood dowel makes a handle. The handle and rods can be cemented into holes in the discs with epoxy. Drill extra holes in the bottom disc to let developer circulate freely.

—Walter E. Burton, Akron, Ohio

Removable flap for a camera case

Some leather camera cases have a permanently riveted-on front flap that can flop around in front of the lens and be generally annoying. You can make your flap removable by drilling out the rivet and replacing it with a pull-apart snap fastener, as shown at left. Snap kits that include a handy punch tool for installing them can be found at notion counters in variety and department stores.

—Robert Hertzberg, Flushing, N. Y.

(For more Photo Hints, see page 16)

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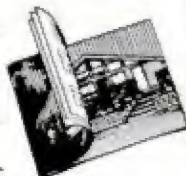
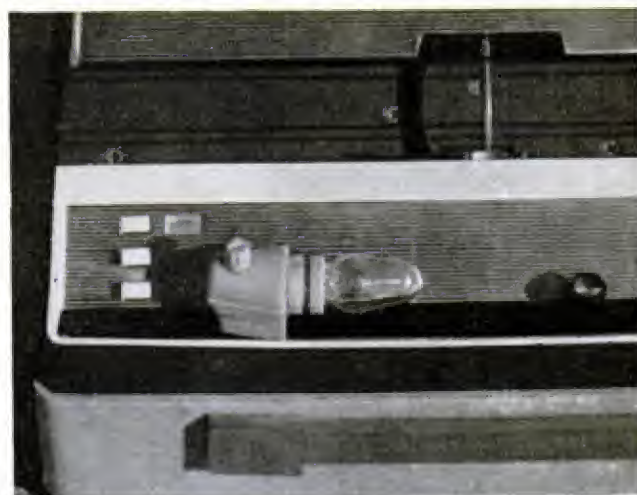


PHOTO HINTS

(Continued from page 14)



Reloading light for projectors

Many projectors have an outlet that turns on a room light when the machine is shut off so you can see to change reels or slides. However, this sudden brightness can annoy viewers accustomed to the dark. A small night light plugged into the outlet provides plenty of illumination for reloading without disturbing viewers.

—Alfred H. Honest, North Palm Beach, Fla.



Quick labels for photo chemicals

Plastic stick-on letters let you make neat, colorful labels for darkroom chemical jars. They come in punch-out sheets in various sizes and colors and are sold at stationery and office-supply stores.

—Arthur L. Ramos, San Anselmo, Calif.

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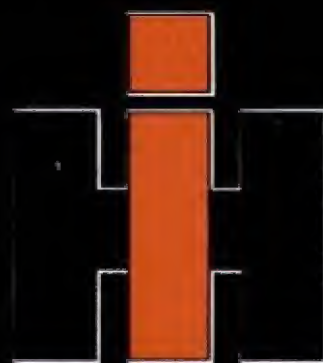
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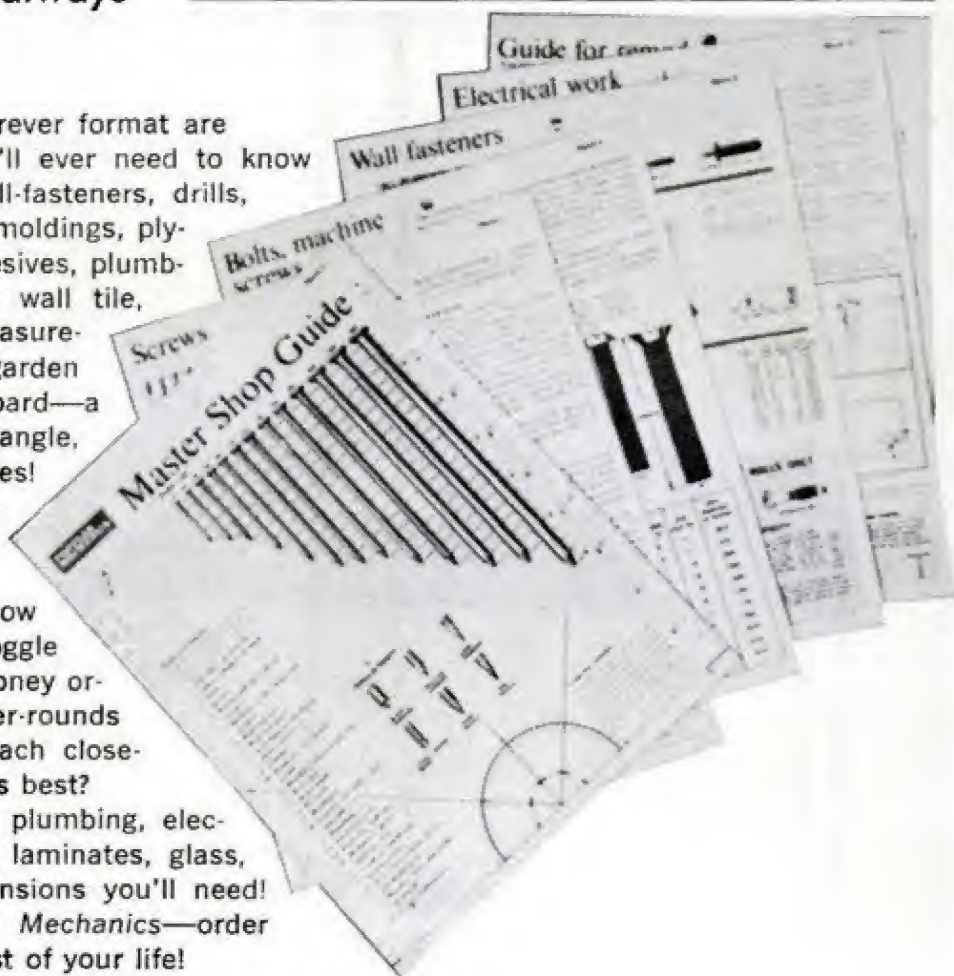


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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Bucking Pinto

My 1971 Pinto runs and jumps after I turn the key off. This may sound like it needs an ordinary tune-up, but I have had the car in the shop four times in the past two weeks and the mechanics have adjusted the carburetor and set the timing. I note that the carburetor is not equipped with a solenoid as is shown in my manual. The car has the 2000-cc engine with 4000 miles on it and air conditioner. Please help this sick car and tired man.—Roger Hill, Charlotte, N.C.

The fact that your car is not equipped with a solenoid is significant. This is an important part the engine should have to prevent dieseling. Improper adjustment of the carburetor and ignition timing in particular will also cause the engine to run and jump after the ignition is turned off. But without the throttle solenoid, the engine is prone to dieseling despite a perfect tune-up. Bring this to the attention of your Ford dealer. Refer him to page 68 of your Pinto Do-It-Yourself Manual or page 24-10-02 of the 1972 Ford Car Shop Manual, Volume II. If he appears argumentative, insist on talking to a factory representative and let him settle the dispute.

Chevy motor-mount problem

I own a 1965 Chevrolet and am concerned over the apparent motor-mount problem publicized recently. According to what I have read, a defective motor mount is a dangerous thing. Is there a way for an average car owner without too much mechanical ability to detect a bad motor mount?—Alfred Zebersky, Brooklyn.

I would become suspicious if I heard a loud noise when accelerating from a standing start, if there were excessive movement of the transmission control lever, or if I felt a "thump" as I backed off on the accelerator at low speed. I would immediately get the car to a shop and have the mechanic carefully lift the engine with a jack. If mount separation has occurred, it will be readily visible. The mount, of course, should be replaced.

Don't procrastinate. A bad motor mount

spells trouble. It could cause the throttle to stick. It could also allow the engine to rise far enough off the chassis to send the fan into the radiator.

High flyer

I have a 1970 Valiant Six with less than 8000 miles on the speedometer. On my first trip to the Blue Ridge Parkway the temperature of the coolant remained normal while cruising (45 mph). Upon stopping for lunch, the coolant boiled over and the temperature gauge hit the limit. This occurred everytime I stopped. Air temperature was in the 80s and the altitude was about 4000 to 6000 feet. Is this usual?—Joseph A. Lane, Durham, N.C.

I assume you're not making a common error of becoming alarmed at a high temperature reading when you stop. Your gauge *should* go into the red when you slow down and idle or stop. Don't worry about it and don't remove the radiator cap—that'll certainly cause the radiator to boil over. If you do much mountain driving you could equip your engine with a 22-inch, 14-quart radiator and a seven-bladed fan. Original equipment is a 10-inch, 13-quart radiator and a four-bladed fan. But before going to this expense I would look into the causes of poor coolant circulation, such as a collapsed lower radiator hose, a thermostat that is hanging up, a broken or loose water-pump impeller or a restricted radiator.

Timely tire topic

With all the glass-belted tires in use today, I'm wondering if they should be rotated, and in what order? I've received different opinions.—D. D. Waisath, Morris, Ill.

According to the Rubber Manufacturers Assn., which represents the tire industry, glass-belted tires should be rotated in the conventional manner. You will find the rotation procedure for your car in the car owner's manual.

Wrong steer

The car is a 1968 Oldsmobile Cutlass
(Please turn to page 22)

AUTOMOBILE CLINIC

(Continued from page 21)

with power steering. When I drive it over 50 mph, the steering wheel often doesn't want to turn. With some effort it suddenly moves a quarter-inch—in either direction. The trouble showed up once at 20,000 miles—again at 40,000—now at 51,000 it is doing it 40 percent of the time. Oldsmobile mechanics have lined the front end, balanced wheels, checked power-steering fluid level, mixed STP with the fluid and checked the steering column. A new belt was also put on. Help me before I kill myself.—Jack Pittman, Kansas City, Mo.

Your mechanics have only scratched the surface. Many more conditions can cause this problem. Has anyone pressure-tested the pump output? Did anyone check the power piston for wear and damage? Maybe the cause is in the steering with a binding linkage or a misadjusted cross shaft. It could also be a sticky gear spool valve, binding gear-to-column coupling, badly worn lower ball joints, or sticky pump flow-control valve. A thorough mechanic is hard to find. Keep looking.

Jittery timing light

I can't get a stationary indication with a timing light on my 1969 Pontiac with 400-cu.-in. engine and 2-bbl. carburetor. It floats as much as 20°, before and after the 9° BTDC mark. The distributor has been dismantled and rebuilt. What now?—CM. Sgt. Robert Gallik, Columbus AFB, Miss.

If timing is being done properly—specifically, if the hose from the distributor vacuum advance unit is being disconnected and plugged—then the trouble is probably in the distributor. I assume that when the unit was rebuilt it was checked for pitted and misaligned points and for proper point spring tension. A worn or loose breaker plate can cause flotation as can a worn distributor shaft or bushings which may not have been investigated. Finally, there may be excessive play in the cam gear-to-distributor gear, and the timing chain may also have too much play. Incidentally, the correct timing spec for your engine is 8° BTDC.

Shrinking seal

I have a 1970 Mercury Marquis and have just had the right-rear-wheel grease seal replaced for the fourth time. The seals hold for about 5000 miles. The dealer blames the trouble on Japanese-made seals. He says the axle and bearings are okay.—Ralph Corbin, River Falls, Wis.

Rear-wheel grease seals fail often because of worn or damaged housings—not because they are made in Japan. However, Ford has told me that severe climatic variations have caused these seals to leak because of shrinkage. A new seal has been introduced, and you should advise your dealer to see technical service bulletin 2, article 25 (10/1/71). The part number for the right-side seal is D1AZ-1177-A; for the left-side seal, D1AZ-1177-B.

Service Tips

● 1971 Dodge Colts may have a refueling problem caused by the fuel line hose being kinked between the main tank and the sub tank, or between the fuel filler neck and the sub tank. It's worth a look.

● Chevrolet makes a good point: Premature drive-belt failure may be caused not only by undertensioning, but also by use of an incorrect sequence when two belts are riding over a common pulley. On six-cylinder engines with power steering, for example, the power-steering belt rides over the Delcotron pulley. If the power-steering belt is tightened before the Delcotron belt, the result is either an over-tensioned power belt or an undertensioned Delcotron belt. On a V8 with power steering and airconditioning, the airconditioner belt rides over the power steering pulley. The same trouble will occur if the airconditioner belt is tightened first.

● 1971 Oldsmobile Custom Cruiser owners are heading for trouble if the differential fluid level is checked as on other model Olds. The position of the differential housing in this car changes the checking procedure. To determine if the level is within limits, put a 90° bend into a pipe cleaner about 1½ in. from the end and insert it level into the filler plug hole. Measure from the bend down to the fluid line. It should measure no less than 5/8 in. and no more than ¾ in. If the differential is overfilled because of a faulty checking method, you could blow the seals. ★ ★ ★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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Now: A TV cartridge player you can actually buy

By JOHN PEARSON and SHELDON GALLAGER

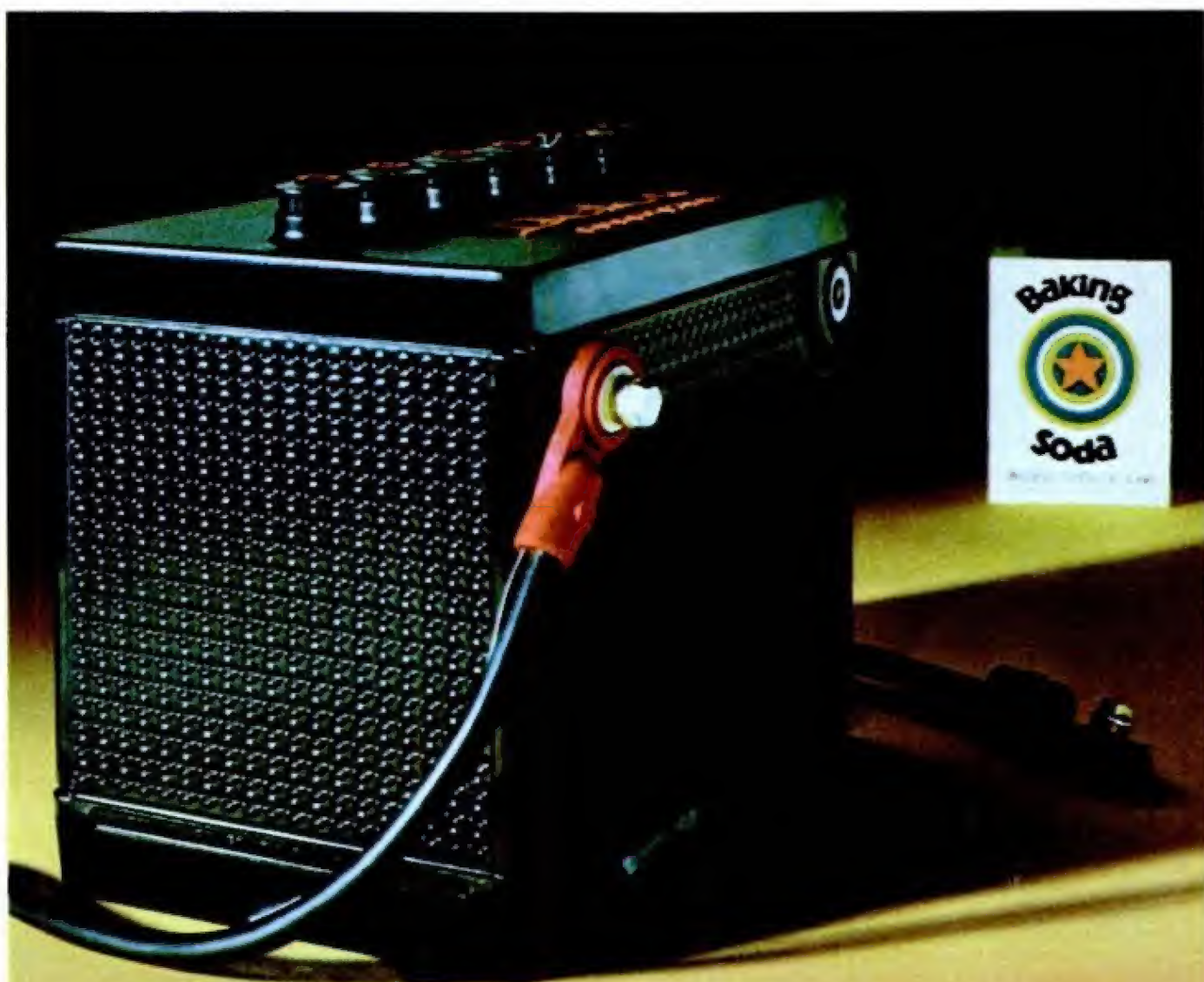


WITH ALL THE SCRAMBLING to get television cartridge players on the market, it's probably significant that the fine old firm of Sears, Roebuck is among the first to announce one you'll soon be able to walk into a store and really buy. Starting in June, the company, which has introduced so many new products to Americans over the years, will begin distributing a complete play-your-own-TV system made especially for home use. First models will contain a 25-inch color TV and a videotape recorder/playback unit in a console, plus a small, lightweight TV camera.

With the recorder/playback unit, you can play prerecorded cartridge tapes in color and also record programs directly off the air in color. All you do is slip a cartridge into a slot on the front (center photo at right). With the accessory camera, you can make "home movies" on tape and view them on the TV screen (lower photo). These, for the moment, will be limited to black-and-white pictures.

Price for the package will be about \$1600. Later, however, Sears plans to bring out a playback-only adapter for less than half or about \$750. With this, you'll be able to play prerecorded cartridges on an existing color TV without having to buy a new set. Also coming is a color TV camera. Prerecorded cartridges will rent for \$3 to \$5, while blank tapes will be sold outright for \$13 and up. ★★★





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The Delco man has the ST in stock now, and he's also got the cable and connector kits to adapt current and older model cars to tomorrow's idea in batteries. Have him tell you all about the ST's tough design and construction. And get it.

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I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish*! And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned*! I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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SHORTWAVE & HAM RADIO — For the listener, Heath has a brand new solid-state SWL receiver. For the radio amateur, there's the complete line of Heathkit receivers, transmitters, transceivers, novice rigs and accessories.

FISHING & BOATING — The new Heathkit Thermo Spotter lets anglers find the specific water temperature level where trophy fish feed. The new Digital Depth Sounder reading to 199 ft., costs about half the price of other units. In addition there are Heathkit flasher-type depth sounders and fish spotters, power inverters, hailer, VHF phones, etc.

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Drivin' with Dan

Who do you think will be this year's Can-Am champ? How did the '72 Eagle do in tests at Ontario? Can 18-year-olds do any professional road racing? Dan Gurney answers these and other automotive questions

Q. What personal street cars do you own that you paid for yourself—actually paid hard, cold cash? Don't count those that were gifts or prizes!—Felix Rivera, Bayamon, Puerto Rico.

A. A Ford Pinto two-liter. Red with mag wheels. My wife Evi drives it and likes it very much. I usually drive one of AAR's Chevy pickups or ride my Harley, Norton or Yamaha when weather permits.

We've been experimenting with bikes at AAR recently. One of them is shown below.

Q. Where would you put your money if betting on one winner of this year's Can-Am series: On Donohue and Porsche? Or on Stewart and McLaren?—George Tsongas, Portland, Ore.

A. Stewart and McLaren. Where would you put yours? There's more on this subject in Bill Hartford's cover story, '72 Road-racing preview, starting on page 75. Sounds as if he's rooting for Donohue!

I'd like to make an Eagle for Can-Am, but we are just too busy with Indy cars at this time.

Q. How much horsepower does the Turbo-Offy and Turbo-Ford put out? Why is it that neither engine (without turbochargers and exotic fuels) is used in Formula 1 and other types of racing besides championship and dirt-track cars? Have there been any books written on your life, and if so what are they? How many Formula 1 races did you win and in what years, cars and engines?—P. Johnson, Paradise, Pa.

A. Between 800 and 850 hp for a very good one. They are too large for Formula 1. No books, yet. I won seven Formula 1 events. One in 2.5-liter BRM four-

cylinder, two in a Porsche 1.5-liter eight-cylinder, two in a Brabham 1.5-liter V8 Coventry Climax, and two in an Eagle with a three-liter, Twelve Gurney-Weslake engine.

Q. I've heard that last December, Dan, you spent some time at Ontario Motor Speedway testing your new championship car. Did you drive it? Can you tell me how it performed, what you feel are the car's strengths and weaknesses and how driver Bobby Unser reacted to it?—Paul Anderson, Dayton, Ohio.

A. No, I didn't drive. I feel that it performed very well in that it bumped the record 186.7 mph up to 190.2 mph. Bobby Unser did the driving, and he says that it is the best car he has ever driven. I cannot talk about strengths and weaknesses. We do not know how fast the opposition will be able to go this year, so we are continuing our quest for

(Please turn to page 28E)

DAN RIDES FOR RELAXATION, but All American Racers has also been experimenting with motorcycles for racing, mainly working on frames for a flat-track racer. Bikes they're working with are Yamaha 750s; this one is ready to scramble!



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Tom McCahill

Automotive test writer

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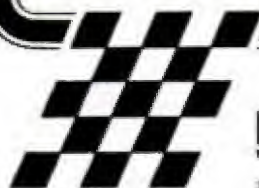


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4. No purchase is necessary. All prizes will be awarded. Prizes are non-transferable and non-redeemable for cash. No substitutes are offered. The odds of

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6. First prize is a new MIDAS Mini Motorhome, standard equipped, Model 618M. Estimated retail value \$7,995.95.
Second prize will be ten Hiachi color portable television sets. Estimated retail value \$349.95.
Third prize will be one hundred Sports-

men flashlights. Estimated retail value \$3.95.
Contest begins December 5, 1971 and ends June 1, 1972. Entries must be postmarked prior to closing date. For a list of winners, send a stamped self-addressed envelope to RV Services, Dept. M818, P.O. Box 292, Menasha, Michigan 49868. Delivery of the first prize is f.o.b. Elkhart, Indiana. All other prizes will be shipped directly to the winners.



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DRIVIN' WITH DAN

(Continued from page 28B)

more performance both in speed and reliability. (We went back and ran 191.4 at Ontario on Jan. 16!)

Q. Have you ever tried your hand, or the seat of your pants, in radio-controlled model-car racing? How does it compare to actual racing?—John Frassi, Seaford, N.Y.

A. No, but I'd like to do it. Several of the men here at AAR are radio-control sailplane and glider enthusiasts. Radio-controlled model racing probably is very similar to real racing: You need a fine touch on controls or you'll "lose it!"

Q. Dan, a friend told me that 18-year-olds can now road race professionally in the United States. Is that right?—Nat Pennypacker, Philadelphia.

A. Partially right. What your friend is referring to is the Sports Car Club of America's new ruling that 18-year-olds can now get insurance and enroll in SCCA driver schools, with parents' consent, and be able to compete in club racing. It's a most welcome change from the previous 21-year-old requirement.

You still have to be 21 years old to compete in the professional series like the Can-Am, Trans-Am and Continental, however.

Q. I am considering buying a 1972 Ford Gran Torino. I would like your opinion on ordering "competition" suspension and "Traction-Lok" differential since 90 percent of my driving is on highways (60 to 70 mph) and very little driving over rough roads. Do you think these options will make my car more stable and safer?—John Pena, Nacogdoches, Tex.

A. I think you ought to get them; I would. You can read what owners have to say about this car in June when PM will run a Torino Owners Report.

Q. I am working on a 1965 VW chassis. I have already removed the body and cleaned off the chassis. My problem is where to mount the new motor, front or rear. I am going to mount a six-cylinder engine first to test out the suspension and steering. I will eventually use a Pontiac 389 engine (bored-out, tri-carb, etc.). If you suggest a rear-mounted engine, would you recommend a

(Please turn to page 28F)

DRIVIN' WITH DAN

(Continued from page 28E)

transaxle or modified driveshaft in a conventional drive train setup?—Dennis Erentsen, Bay Shore, N.Y.

A. I really can't give you a worthwhile opinion without more particulars, but I'll give one anyway! I'd say rear engine and a trans-axle. It seems as though your eyeballs are going to be very close to the windshield!

Q. Dan, can you tell me what to look for in the way of new and different cars at the USAC 500 milers this year?—John Austin, Cedar Rapids, Iowa.

A. I don't think you will see any really radically different designs in 1972. The new cars will be a lot faster than they were in '71, but the reasons for the speed increases won't be so apparent to the eye.

Q. I just heard that GM is finally making that recall on Chevrolets with the engine-mounts problem. Have you ever "recalled" any Eagle racing cars? If so, for what?—Vinnie Aviles, New York.

A. We have contacted all of our customers on one or two occasions with advice about checking certain weaknesses that have cropped up in our front hubs and our rear uprights. We have never been in a position to fix things free of charge. It is staggering to me to consider recalling cars by the millions. A momentous decision to say the least.

Q. Have you ever driven a go-kart? How fast? I've heard they're getting more sophisticated. Is that true? How?—Bob Emilian, New York.

A. Yes, I have. In fact I raced one down in Nassau in 1959. I ended up with a broken foot after losing it while in second place. I had started 28th.

Yes, like most other forms of racing, they have become quite sophisticated—engines, brakes, tires, wheels, chassis, seats, exhaust systems. Things have changed since the days of just four wheels, platform and engine. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 21).



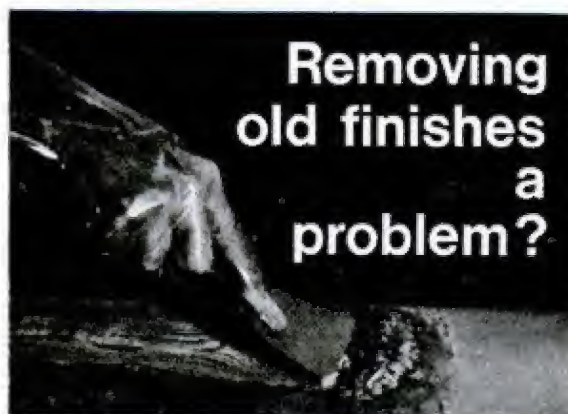
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ALL OUTDOORS

By BILL McKEOWN

FEW SPORTSMEN recall President Grant as an ardent outdoor type in time of peace, but on March 1, 1872, he signed the act that made a Yellowstone River area into the world's first national park. John Colter, guide and trapper for the Lewis and Clark expedition, had explored this majestic wilderness region alone in 1806, and brought back tales of its mountains and canyons, hot pools and geysers that earned him a reputation as a loner and a liar. But now the National Park System is celebrating its centennial year and has grown to include 280 examples of America's natural and historical heritage. More than 100 other nations have copied our example and set aside over 1200 national parks and reserves. Chances of our park system growing or even standing pat over the next 100 years would seem to depend on outdoorsmen safeguarding what we've got.

SHOTGUN SHELL comparative tests are being conducted by Winchester, Remington and others to determine if "iron shot" (actually steel) can be substituted for the traditional lead. Waterfowl eat spent lead pellets and contract lead poisoning. Iron, on the other hand, does not seem to have the carrying power and range of lead. Use of a slightly larger iron-load shot size appears to be one answer. Shells using the iron shot are expected to be slightly more expensive than the lead-loaded shells, but sportsmen and conservationists foresee that they will eventually replace lead for all waterfowl hunting in the United States to stop waterfowl losses caused by ingested lead shot.

AIRCRAFT HUNTING has now become a Federal offense with the passage of Public Law 92-159 providing for a criminal penalty for shooting or harassing any bird, fish, or other animal from the air. The law makes exceptions for persons with permits from state or Federal governments and for those who use aircraft within state laws to protect livestock from predators. A number of states already have laws prohibiting the hunting of protected wildlife from aircraft and carrying of loaded firearms in vehicles without special permission. Motorcycles, trail bikes and snowmobiles are usually specifically included in these laws.

NATIONAL PARK FIREARMS regulations also prohibit the carrying of loaded firearms in

or out of vehicles on National Park lands. Federal law allows the transport of unloaded firearms through National Parks, but "unloaded" means no cartridge or projectile in the clip, magazine or firing chamber. Some state laws allow hunters to transport firearms in or on a vehicle with live rounds in the clip or magazine but prohibit live rounds in the firing chamber. Shooting from a vehicle or public road is often banned.

HIGH HUTS, those simple rustic structures offering primitive shelter for mountain campers and backpacking hikers, are now being considered for construction by five bureaus of the Department of the Interior. The agencies involved—the Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs and Bureau of Reclamation—together manage more than half a billion acres of land in 48 states and Alaska. The "high huts" are fairly common in alpine areas of Europe and are usually open on one side. Department of Interior plans call for selection of sites near recreation areas, along trails and rivers in the back country, and near—but not inside—areas officially designated as wilderness, where no permanent roads or structures are permitted. Design of the huts would include use of native materials so that they would blend in well with their surroundings, be low in cost, and quickly and easily constructed. An Interior Department memorandum notes that, while the number of back-country hikers has grown enormously in the last few years, there has been no Federal program to provide more of these simple shelters.

SALTWATER SPORT FISHING is getting so big the U.S. Department of Commerce Bureau of Census recently conducted a special survey and came up with figures indicating there are 9.5 million saltwater anglers who spend an annual \$1.4 billion on their sport. Data on the number and weight of each species caught, as well as fishing method and area of fishing, are also being tabulated—assuming each fisherman gave the census taker accurate information about such mystic data as the true weight of each fish he caught and just how and where he caught it. The survey shows the greatest concentration of marine sport fishermen on the eastern seaboard with about 5 million anglers fishing the Atlantic coastal waters;

over 2 million fished the Gulf of Mexico; another 2 million plus the Pacific Coast. Average annual expenditure per man was about \$144.

THE BEST FISHING MOVIE I've ever seen and possibly the best ever made is called *The World of Sport Fishing* and is now being released nationally by Allied Artists. Watch for it. Some segments you may have originally seen on ABC television. Now fitted together by Pat Smith into a feature-length film, it shows parts of a 13-hour nonstop battle when Lee Wulff decks a world's record 597-pound bluefin tuna on 50-pound test line. Then there are other famous fishermen like Joe Brooks stalking permit off the Florida Keys, Bing Crosby landing salmon in Iceland, Jack Nicklaus taking tarpon on a flyrod, Ernest Borgnine fighting black marlin in Australia and Phil Harris rafting for trout on the Snake in Wyoming. The show turns a quiet sport into nonstop excitement.

BIG FISH FOR LAKE MICHIGAN are predicted as a result of small fry plantings of rainbow trout and king or Chinook salmon during the winter in aerated waste treatment lagoons in Illinois and Wisconsin. The system, which is reported to cost only one-fifth as much as normal stocking methods,

allows the fingerlings to grow large enough so they will not be attacked and eaten by predator perch once they are transplanted to Lake Michigan. Fish weighing 50 to 100 pounds are forecast for lakefront fishermen in the next five to seven years.

MOTOR HOMES will be converging on Eustis, Fla., this month for a rally of 1000 vehicles sponsored by the Family Motor Coach Assn. and the Dodge Recreational Vehicle Service Department. Nightly programs include a barbecue and country dancing, while servicing and maintenance seminars are to be offered during the day.

READING OF SPECIAL INTEREST for boatmen includes a recent free booklet prepared by the Michelob Beer Div. of Anheuser-Busch, St. Louis, Mo. 63118. Called *The 'Boating Bug'* it describes and diagrams boat handling and docking in helpful detail. From Dept. SS, Johnson Wax, Racine, Wis. 53403, for 50 cents is *Shipshape*, a booklet covering both seamanship and maintenance. And to scare you away from the waterfront forever, Doubleday has a new novel called *The Twelfth Mile*, by E. G. Perrault, that gives some of the best descriptions yet of the huge tidal waves named "tsunamis." ★★ ★

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APRIL 1972

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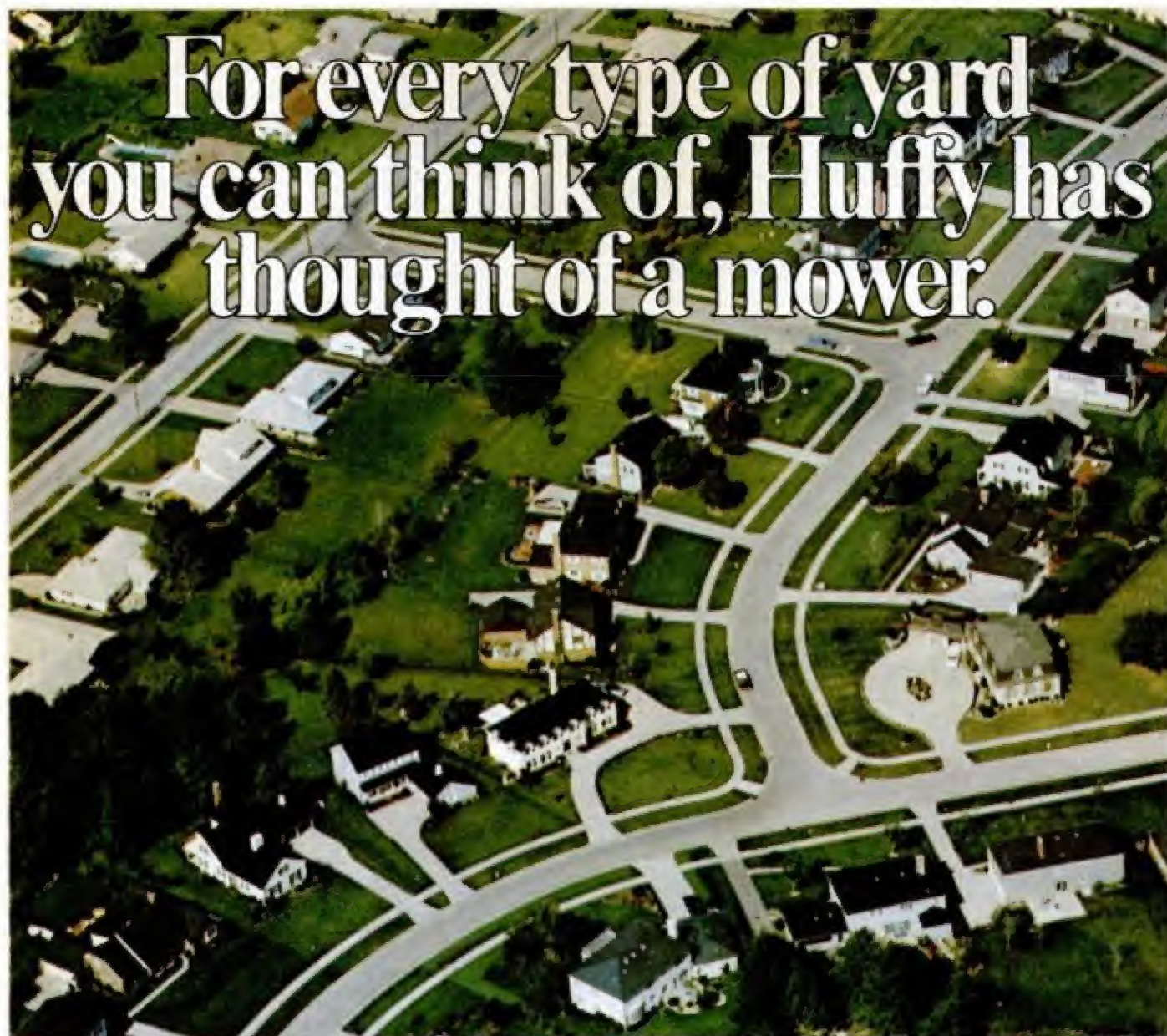
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THE BICYCLE SHOP

By EUGENE A. SLOANE

PM's newest columnist, the author of 'The Complete Book of Bicycling,' offers many valuable tips for your care of chains, freewheels and hubs

THE BICYCLE PART most exposed to dirt and grime is the chain. The one used on 10 and 15-speed derailleurs is especially vulnerable to wear because it does not have a metal dust cover.

You should clean and lubricate your chain after every long trip. If you do a lot of bicycle commuting, clean and relube it once a week. The job pays dividends in reduced wear on the chain and on parts it contacts: chain-wheel, rear-wheel gear cluster and derailleur mechanisms.

Don't try to clean and lube the chain on the bike. You'll drip kerosene and oil on the tires, which greatly shortens tire life. The chain can be properly cleaned only by agitation in a shallow pan of kerosene. (Don't use gasoline.)

Narrow, $\frac{3}{32}$ -inch derailleur chains do not have the type of master link used on conventional $\frac{1}{8}$ -inch-wide, three-speed

RIVET REMOVER is essential for working on the smaller, $\frac{3}{32}$ -inch chains used on derailleur bicycles



DERAILLEUR ARRANGEMENT shows how chain is tensioned on the freewheel gear cluster on the rear hub

bike chains. To remove a derailleur bicycle chain you will need a rivet remover (it costs about \$2). Put this chain-rivet tool on the chain so that a chain rivet is lined up with the tool. Screw the tool handle clockwise until the rivet is almost, but not quite, all the way out. *Do not push the rivet all the way out!* If you do, you will have to add another link or try to get by with one link less. (Note: do not "mix" links from other makes of chains.)

Practice with a piece of old chain until you can push the rivet out just far enough, so that when the rivet tool is removed you can take the chain apart by gently twisting the chain to one side and pulling it apart at the rivet you pushed. If you have pushed the rivet out just far enough, about $\frac{1}{16}$ th of an inch of it will be left showing on the inside of the link.

To reassemble the chain, simply slide the two ends of the chain together. You will feel a slight "pop" as the $\frac{1}{16}$ th-in. section of the rivet slides into its link. You can then unscrew the rivet-removing tool enough to be able to put it back on the chain, lining it up with the protruding end of the rivet. Then, screw the rivet-tool handle clockwise again to force the rivet back into place. Make sure you push the rivet in only as far as the adjoining rivets. If it is pushed in too far or not far enough, it can either rub on the rear gears or pop out the next time you are straining up a steep hill.

Once the chain is back together, twist it gently from side to side to remove stiffness at the rivet and link where you took it apart. If you can't find this link, just move every link up and down until you locate the stiff one; this is important because a

(Please turn to page 32)

THE BICYCLE SHOP

(Continued from page 31)



REMOVE FREEWHEEL following procedure in text. Removal tools are for Schwinn and Atom freewheels (left), for Reginas (center) and for Shimanos (right)

stiff link can cause the chain to jump off front or rear gears.

When the cleaned chain is back in place,

relubricate it with a good motorcycle chain lubricant—the type that comes in a spray can. As you slowly rotate the chain by turning the pedals, carefully spray the inside of the chain until all links have been lubricated. Wipe off excess lubricant with a rag. *Be careful not to get lubricant on bike tires.* Ideally, the bicycle should not be ridden for a few hours to let lubricant penetrate to all chain-link rollers.

For chain lubricant I have received excellent results with Lubriplate "Chain-lube" (a six-ounce can costs about \$2 in motorcycle shops and should lubricate your chain about 10 times).

This lubricant is a penetrating, fairly dry type I have found resists picking up dust, sand and other abrasives from the road. In my book, *The Complete Book of Bicycling*, I recommended SAE 90 viscosity rear-end oil for lubricating bike chains, and I hereby withdraw that recommendation on the basis of later experience. You have to soak a bike chain overnight in 90 viscosity oil, and this heavy oil picks up sand and dirt like a magnet.

FREEWHEELS. While the chain is off, spin the rear-wheel freewheel gear cluster to make sure it's running freely. Once

(Please turn to page 34)

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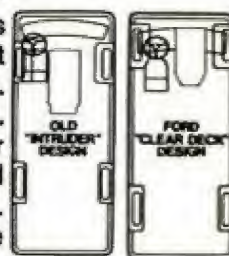
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THE BICYCLE SHOP

(Continued from page 32)

every 500 miles or so, or once a month, the freewheel should be removed, soaked and agitated in kerosene, relubricated with a light SAE 5 viscosity oil. Heavy oil will attract dust and can also cause internal pawls to hang up so that the freewheel will spin in both directions. If it spins forward the rear wheel won't turn.

To remove your particular freewheel, you will need a tool to fit it. The three basic makes of freewheels requiring their own removing tool are Schwinn-approved and French Atom, Regina and Shimano.

1. Remove rear wheel.

2. Remove the skewer or nuts holding hub to rear drop-out.

3. If you have a Regina freewheel, insert the two teeth of the removing tool so they fit into matching recesses in the freewheel side. Reinsert the skewer or draw up wheel nuts so the freewheel tool is held snug (but loose enough so the freewheel can be backed off half a turn).

If you have a Schwinn-approved, Atom or Shimano freewheel, you will first have to remove the first locknut and all spacer washers on the freewheel side of the hub. This can be done without entirely dismantling the hub axle assembly, if you do it carefully. First put the freewheel side of the hub in a vise so that the vise holds the spacer locknut. Then put a 13, 14 or 15-centimeter thin hub wrench on the cone nut on the side *opposite* the freewheel side of the hub. Twist hub wrench on cone nut counterclockwise, and spacer locknut on the hub side should loosen.

If it doesn't, the simplest way to remove this locknut, while it's still held in the vise, is to remove the cone locknut on the hub side *opposite* the freewheel with an open end wrench, while holding the cone nut on the same side with the cone wrench so it can't turn. Then loosen the cone nut about eight or ten turns or enough to let the cone locknut on the freewheel side go far enough from the freewheel hole to slip a cone wrench on it.

At this point turn the wheel over and insert the opposite cone nut in the vise. Holding the freewheel-side cone locknut with the cone wrench so it can't move, loosen the cone spacer locknut on the freewheel side and take it off entirely. Be careful not to loosen the cone nuts so far as to permit the hub's ball bearings to roll out where they can be lost.

4. Put removing tool now on the freewheel into a vise and twist the entire wheel counterclockwise about a quarter-turn, or just enough to loosen the freewheel. Remove skewer or wheel nuts and

take the freewheel off the hub using an open-end wrench. It should come off easily.

5. When reinstalling freewheel, thread it on the hub carefully. Most good hubs are made of aluminum—far softer than the steel threads of the freewheel. It's easy to strip hub threads if you aren't careful.

HUBS. If your hub is due for lubrication, (about every 500 miles or whenever hub sounds and "feels" gritty), you can go all the way and remove one cone nut altogether. In this case, put the hub and wheel over a rag on the floor to make sure you catch all loose bearings.

1. Clean hub and bearings in kerosene.

2. Check hub races for wear, and balls for wear and cracks. Replace cracked balls with new ones; take a sample ball to a bike shop to get the right size.

3. Put a light layer of grease on both sides of hub bearing surfaces, and on balls. Insert balls in freewheel side of hub. You will have previously removed axle with cone into hub and bearings. Insert axle and cone into hub and bearings. Insert splined washer and locknut (thin one) and tighten locknut, holding the cone nut with thin cone wrench.

4. Holding the axle in place, turn the wheel over and put it in the vise so vise jaws hold locknut on the freewheel side.

5. Insert ball bearings in hub. Thread cone nut in place, tighten it by hand until snug, then back off a quarter-turn.

6. Insert washer and locknut. Hold cone nut with the thin cone wrench so it won't turn, tighten locknut with open end wrench.

7. Remove wheel from the vise and spin axle between your thumb and forefinger, and check for "binding" or rubbing. Twist axle from side to side to check for sideplay. Put tire valve at 3 o'clock position, and make sure wheel turns by weight of valve alone. If wheel binds, loosen cone locknut and cone slightly; then retighten cone locknut. If wheel has sideplay, loosen cone locknut while holding cone with wrench; tighten cone slightly, retighten cone locknut while holding cone nut as before. Wheel should be in vise, so cone locknut on freewheel side is held by vise jaws, when readjusting cone. Turn wheel over in vise and thread on freewheel and remaining spacer washer and locknut. Tighten locknut. Be sure that axle extends equally from each side of hub (about $\frac{1}{4}$ in.).

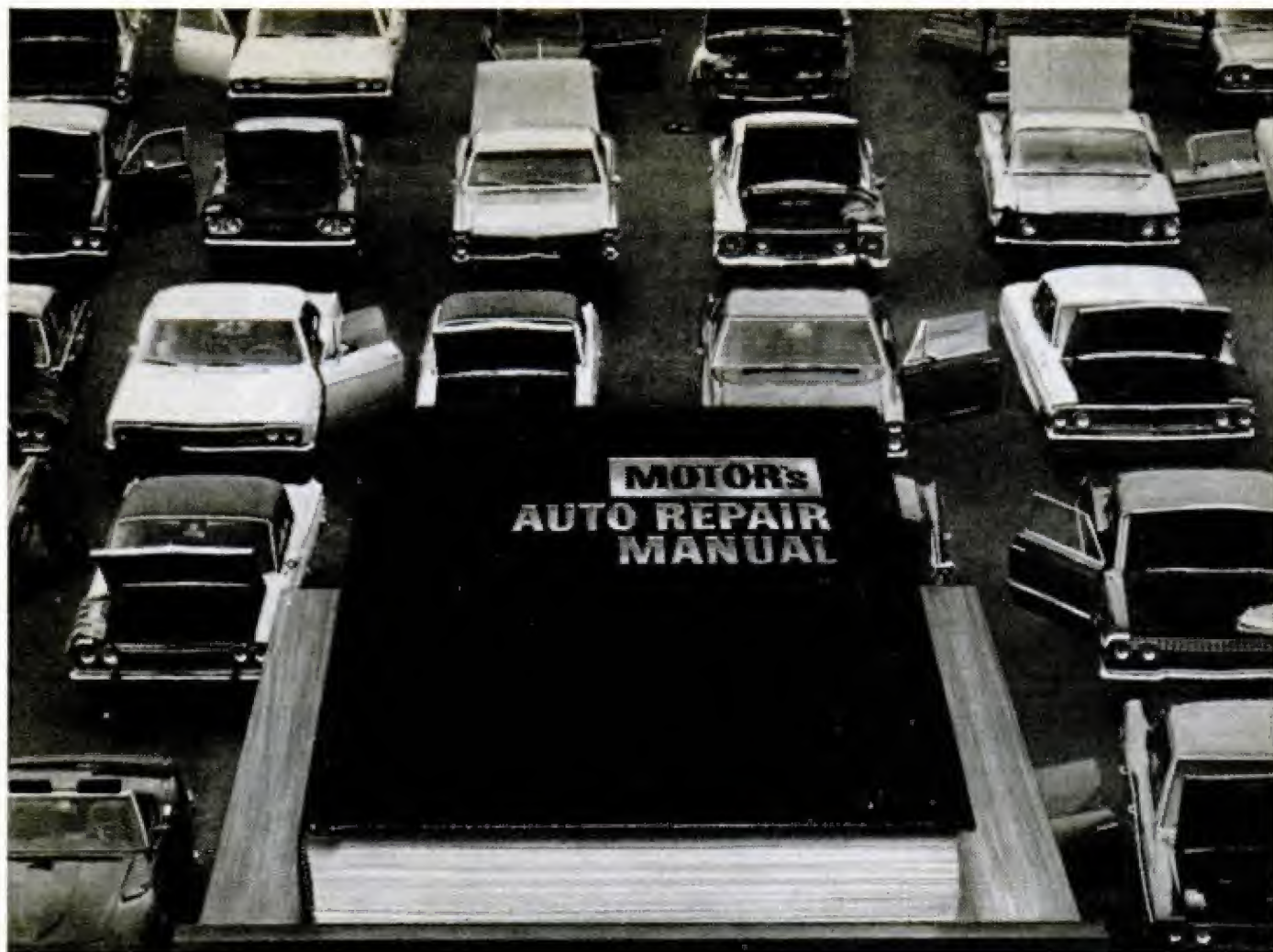
After trying many lubricants for hubs, I've narrowed my choice to two. The first choice is Lubriplate Marine Lube "A" (at most marine supply stores) or an identical grease called Lubriplate Autolube "A" (at most auto supply shops). ★★★

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Wood-shingle roofing

I'm having a home built this spring and I want a cedar-shingle roof. My property is outside corporate limits. Are there codes or other regulations pertaining to use of wood shingles?—Robert R. James, Pittsburgh

Most counties and municipalities now approve wood-shingle roofing if the shingles are laid over a glass-fiber-reinforced asbestos paper. However, check with local officials, also your fire-insurance underwriter, just to be doubly sure.

When to roll your lawn

My lawn is rather rough, especially under two large trees, with shallow depressions and hummocks causing the mower to skip and scalp. Soil is clayey rather than sandy and I've been told not to roll it, even though drainage should be good. What's your advice?—Manley Rupp, Dayton, Ohio

Instead of rolling I'd fill the depressions with new soil, raking it level. Scatter new seeding, and keep the soil damp by light hosing, if necessary, until the new seeding shows. I would lift the sod on any hummocks, remove a portion of the soil underneath and reset the sod level with that adjacent. This also should be kept damp until the sod reroots permanently. I hesitate to suggest rolling clay soil, although a light rolling possibly would do some good by pressing grass plants that may have been heaved by frost into closer contact.

Lacquer-thinner 'poultice'

I spilled a few drops of graphited penetrating oil on an unfinished piece of stock prepared for a home-shop project. It has resisted all means I know of for removal. Do you have a suggestion?—Don Skinner, Helena, Mont.

Can you turn the piece over and still use it, or is it good only on the discolored side? If this is not practical, your problem has no simple solution.

I've had a similar experience and finally resorted to lacquer thinner with fairly satisfactory results. Pour the thinner onto

the stain and immediately cover it with a piece of sheet metal. After a minute or two, wipe it with a clean cloth, beginning at the center of the stain and working outward. Chances are you'll have to repeat this procedure several times. After drying the area, you may be able to remove most of the graphite discoloration with an ink eraser.

Fingerprints in putty

On two steel sash in my basement the putty has been deeply fingerprinted, probably by the builders while inserting them. Is there some simple way to remove or smooth these prints without replacing the putty?—Ira Close, Louisville

Usually the putty used originally in steel sash remains soft but forms a fairly hard surface or "skin." By pressing lightly with your fingers on either side of the imprint you might force putty under the imprint and raise it to a level of that adjacent on either side. If this fails, you might try heating the putty with a propane torch; this should soften it sufficiently to permit knifing to a smooth surface. Use a needle flame and aim it so that the glass will not be heated and cracked. And, of course, do this job in warm weather.


Failing both methods, it will be necessary to replace the affected putty strip.

Different decor for milk can

I have a large-size milk or cream can I'd like to decorate—something different from the usual run of milk-can decoration. Do you have a suggestion?—R. M. Dunn, Oklahoma City

Although this is more of an artist's problem, the possibilities offer a challenge. I once saw a can decorated with four oval color illustrations obviously cut from magazine pages. It was handsome. You can draw an oval by sticking two pins into a piece of cardboard, looping a length of string loosely around the pins and striking the oval with a pencil point held against the cord. Size of oval and type of the illustration can be anything that suits your fancy. Paint the can a cream color, cut the pictures to oval shape with the cardboard pattern, stick them in place with white glue and spray them with a clear lacquer from a pressurized container. ★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.



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The trouble with paint is that it forms a film. And when the weather starts working on this film, you get paint failure:

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PM



GE offers three new Elec-Traks

The E8M above is one of three new tractors added to GE's Elec-Trak line this spring. With three Power Pack units powering the driver motor and a 36-inch rotary mower, the E8M will cut one acre of lawn before recharging. The heavy-duty transaxle has three forward speeds, one reverse, and it operates with a single-pedal foot clutch/brake. In addition to this 8-hp model, the new Elec-Traks include 10 and 12-hp units.



Good vibes

For years, it was rumored this British house was haunted—until new owner Stephen Barney found the source of the low moans and "voices." The wind "played" the chimney like a musical instrument. He rebuilt the chimney—crooked—to stop the vibrations.

The Snapper Riding Mower.

Most people don't know that it can take the place of a bulky garden tractor in most instances. And that it costs far less. With the proper attachments, the Comet can doze, sweep, fertilize, aerate, even haul. And it's specifically designed to mow



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science worldwide

By JOHN
PEARSON



Picture window for submersible



Space suit helps heart to pump



One way to order your lobster

FIRST UNDERSEA VEHICLE TO USE GLASS as a structural part of its pressure hull is *Deep View*, a two-man submersible designed at the Naval Undersea Research and Development Center, San Diego. The 44.5-inch-diameter glass nose provides the excellent visibility that also can be achieved with plastic, but permits much deeper dives—to 1500 feet—than can be made in a plastic hull. The six-ton vessel is powered by five electric motors, can maneuver in all directions and can hover. Sea trials are scheduled for this year.

A HOT TODDY MAY BE BETTER FOR YOUR TEETH than ice water or a dish of ice cream. You can draw that conclusion from the findings in a University of Utah study in which hundreds of extracted teeth were examined. Tooth enamel suffers thermal fatigue because of the hot-and-cold cycle that occurs inside the mouth. Hot drinks may raise the temperature to 140° F. while ice cream can drop it to 35° F. Enamel remains strong during thermal expansion resulting from heat, but sudden cooling makes it contract and susceptible to cracking. Tiny surface cracks tend to collect food debris and oral bacteria, thus contributing to the development of decay. This is a problem unique to man—other animals don't bother to heat and chill their food and drink.

A VITAL SPIN-OFF FROM OUR SPACE PROGRAM is a suit that encapsulates a heart patient and assists blood circulation by precise application of pressure to blood vessels in the arms and legs. Electrodes attached to the skin trigger a mechanism that inflates and deflates a series of pressure cuffs working in rhythm with the patient's heart. Tests at the University of Texas indicate that the suit can increase cardiac output by as much as 30 percent.

A BABY'S "CRY PRINT" IS A GOOD CLUE to the infant's state of health. So says a Miami phonetics specialist who for many years has studied tapes of cries of the newborn. He plays the tapes into a machine that turns sound into a visual pattern—"a cry print"—recorded on paper. The print can disclose various neurological and physiological conditions, from serious brain damage to a simple speech defect.

GOURMETS, TAKE NOTE. No longer need Maine lobsters be shipped live to insure that the tender meat is in prime condition when eaten. A Canadian company claims to have devised a method for freezing whole lobsters that keeps them "fresh" for a year and permits shipping anywhere on the globe. The crustaceans are

(Please turn to page 42)

Jeep® Wagoneer hauls everything. Even the kitchen sink.



Jeep guts are so strong, they pull big trailers easily. On or off the road.

When you head for the hills, you don't have to leave anything behind. Not if you're behind the wheel of a Jeep Wagoneer.

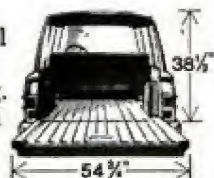


You can't get a larger standard engine in its class. And you have even mightier V-8's as options. That's Jeep guts.

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the trailer. Plenty of glass all around so you can see—and enjoy—where you're driving. Chair-high seats to keep you comfortable. Even after a day's drive.



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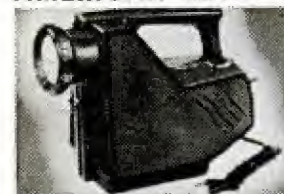
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SCIENCE WORLDWIDE

(Continued from page 40)

steamed a few seconds to kill them, then popped into icy water. Next they're placed in polystyrene "coffins" and blast-frozen. Finally they're vacuum-packed and shipped.

The Environment

IMPROPER USE OF AEROSOL SPRAYS can be dangerous. This was underscored by the results of tests by Medical College of Georgia researchers who exposed dogs to the propellant gas in hair and antiseptic sprays. Thirteen of 16 dogs developed disturbed heartbeats within "seconds to minutes of aerosol inhalation," say the researchers, and eight eventually died.

SMOKE RINGS could be used to carry smokestack pollutants to new heights and perhaps even to penetrate atmospheric inversions of the type that strangle large cities with smog. That's the thinking of Dr. George E. Mattingly Jr., a Princeton University civil engineer who has done much research with "smoke" rings. Scientifically, they're known as vortex rings and they can occur in any liquid or gas. Dr. Mattingly has found that a saltwater vortex ring easily penetrates a layer of lighter fresh water above it and remains intact while doing so. This suggests the possibility of using large, mechanically produced, industrial smoke rings to drive stack effluents through an atmospheric inversion to clearer, windy skies above. Inversions occur when the air temperature, which ordinarily decreases with height, instead increases, causing hot, polluted air to stay close to the ground.

PRISON WALLS ARE NO BAR to pollution. As a result, inmates at the Stillwater, Minn., state prison have formed an organization called Convicts Assn. for Good Environment (CAGE) and have gotten busy cleaning the institution's ventilating system and industrial areas. And, they have begun to recycle solid waste—bottles, cans and paper—which normally is buried nearby.

THROWAWAY CONTAINERS ARE OUT in Oregon. A new state law requires that all beer and soft-drink bottles, cans, jugs or whatever, carry a minimum deposit, as was the case with the returnable bottles of yesteryear.

★★★

NEWS BRIEFS



Rail helps blind to bowl

By sliding one hand along a special rail placed alongside the bowling approach, blind persons determine the time and direction to release a bowling ball and are thus able to participate in the sport. The portable rail, 12 feet long and 3 feet high, is held in place by the weight of four bowling balls. The American Blind Bowling Assn., 6327 31st Place N.W., Washington, D.C. 20015, sponsors leagues as well as national competition.



'Duckie' is mostly aluminum

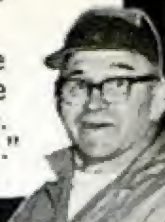
Rolland McKinney, an Alcoa employee, used aluminum for the body, pistons, transmission housing, fuel tank and rear wheels of *Rubber Duckie*, his 1350-pound dragster.

APRIL 1972

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LISTENING POST

BY ROBERT LUND

HAS GM REALLY DEVELOPED SEALS for the Wankel good for 400,000 miles? That's what a high-up source in the company claims. But maybe what he intended to say is that GM believes it can produce a Wankel with a life expectancy of 400,000 miles. With periodic service and overhauling. But that's not the same as saying GM's devised a seal that'll last 400,000 miles.

OLDS GENERAL MANAGER John Beltz says forget that stuff (you read it here last month) about Olds canceling its small car, a mod and modified version of Nova, to make room for a front-wheel drive Wankel in '74. Ain't so, he avers. Olds will definitely have a Cadillac version of Nova later this year. But Beltz doesn't deny the rest of the item—that the first Wankel out the door will have front-wheel drive.

CHRYSLER'S ALREADY WORKING on second and third-generation versions of the electronic security alarm system it will offer as an option on its full-size '73 cars. First version coming this fall protects door locks, engine compartment and trunk by causing lights to flash off/on and the horn to blast intermittently if a thief attempts forced entry. Future versions may incorporate an additional alarm that will trigger if there's an attempt to tamper with the tires.

Chrysler's putting the alarm to the acid test. "The only way to test an item like this," says

Don Wolfslayer, the company's vehicle security specialist, "is to put it out and let the thieves work on it. Then you improve it, depending on what you learn from the thieves."

The 1973 version also has an occupant-protection feature: push the button on the dash and lights and horn sound off. Knowledgeable muggers will have to say, "Stick 'em up and keep your hands off the alarm button on the dash!"

BUILDING 'EM BETTER. The inventors and improvers have been hard at it and their latest predictions and promises include:

- Radiator hose that'll never blow and life-of-the-car radiator caps, heater hoses and sparkplug wires. Compliments of Dow Corning. The company says the parts will be made of silicones and be virtually indestructible. Deadline: by 1975.

- A ride-along-robot hooked into your radio speaker that tells you when you need service or a new part. The hardware consists of monitoring devices that take readings of components and a voice synthesizer with an unlimited vocabulary. When a part needs replacement or maintenance, the synthesizer cuts in on the speaker and tells you what to replace or repair. Federal Screw Works, a supplier to the auto companies, will begin production of the synthesizer this year. The first versions will be expensive—about \$3000

(Please turn to page 46)

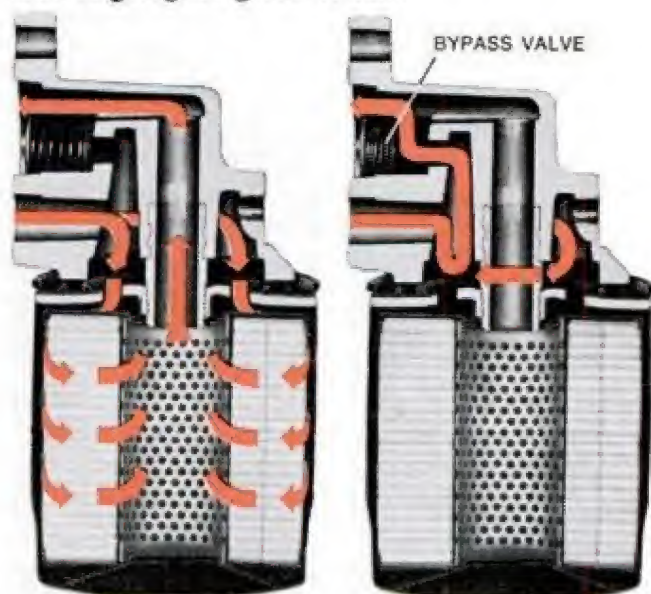
PLYMOUTH CRICKET, available only as a four-door sedan since its introduction, now comes in a station wagon model. The overall length is 166.4 inches on wheelbase of 98 inches, and cargo space is 60 cu. ft.



ASK THE AC ENGINEERS

“ Why is it important to change my oil filter at recommended intervals? ”

Your oil and oil filter should be changed at recommended intervals to help assure protection against damaging engine wear.



NORMAL CONDITION:
Oil flows from engine through filtering material . . . oil returns to engine after all harmful abrasives are removed.

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The function of an AC Oil Filter is to collect and hold contaminants and particles that could cause wear to bearing surfaces and other vital engine parts. It assures that lubricating oil, free of harmful abrasives, circulates through the engine. However, an oil filter performs at top

efficiency for only a specified period of time or mileage . . . depending on driving conditions. Then, it should be changed to prevent driving with a clogged filter.

At AC, we design oil filters to meet specific requirements. Then, we conduct exhaustive laboratory and field tests to make certain AC Oil Filters perform efficiently.

AC's polyester-reinforced filtering material stands up to high engine oil temperatures and pressures . . . and traps dirt and particles smaller than half the diameter of a human hair.

AC Oil Filters . . . original equipment on all Chevrolets, Pontiacs, Oldsmobiles, Buicks and Cadillacs . . . are also available for most other

makes and models. For top engine protection, change your oil and AC Oil Filter at recommended intervals.



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Winchester- Western Staynless Primers

Swift and sure ignition. Two things handloaders demand in the performance of their center fire ammunition and shot shells. That's why our non-corrosive, high-stability primers—the heart of the load—are sought by experienced shooters who custom-make their own center fire loads and shot shells.

Winchester-Western Staynless Primers have been tested under all conditions at temperatures ranging from minus 40°F. to 115°F. Handloaders share the positive results of thorough research — an ignition that's lightning fast and uniform. These quality primers are the result of the same exacting process that has made Winchester-Western loaded ammunition world-famous. Now they're part of the best available matched components system for those sportsmen who "roll their own." **WINCHESTER-~~Western~~**
275 Winchester Ave., New Haven, Conn. 06504.

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the way you
want it

DETROIT LISTENING POST

(Continued from page 44)

—but over the years Federal Screw thinks it can get the price down to \$300. The firm says it will be about five years before the gear appears on production cars.

● Finally, there's Pontiac's answer to deputy sheriff W.W. Henrick. Sheriff Henrick, who keeps the law in LaGrange, Ind., posed a question in the *Letters* column in February. Why don't automakers put a device on cars so drivers can hear train whistles and police, fire and ambulance sirens? With cars becoming more soundproof, windows permanently sealed and radio-stereos blaring, it's almost impossible to hear out-of-car audio signals.

Pontiac's answer is an electronic horn tied in to a radio transmitter-receiver. It works like a conventional horn, but the sound enters the vehicle being signaled over the radio. Pontiac says emergency vehicles and trains could be equipped with special signals to distinguish them from passenger cars. Other advantages: the horn can be heard around corners and over hills, it could be voice-modulated if police want to talk to approaching cars and the radio doesn't have to be turned on to receive the message or signal. It will take several years to get the system going, because it can't be put into operation until the FCC assigns a special frequency for the sending-receiving equipment.

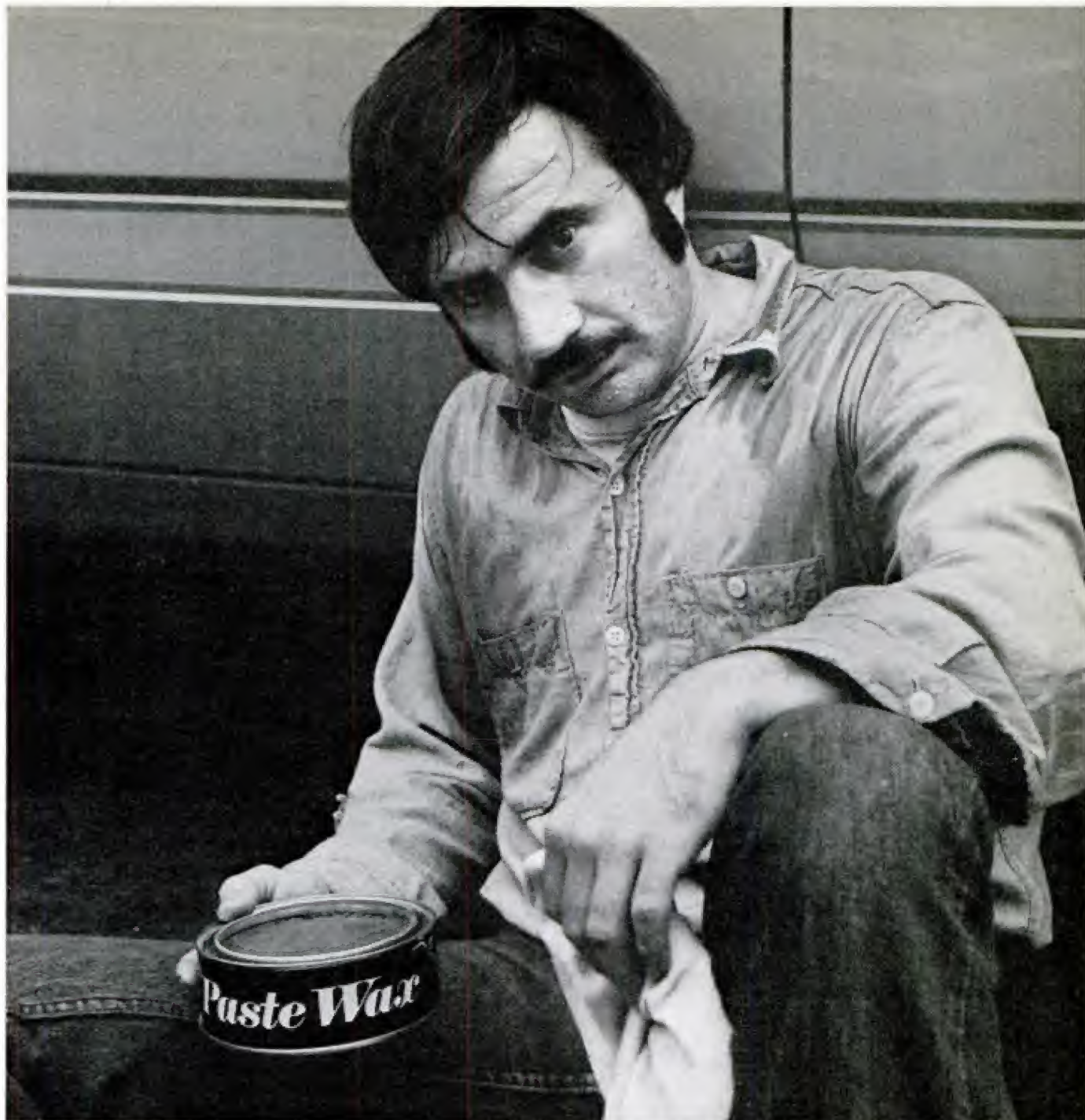
SEVERAL TIMES this past winter I came within a whisker of getting rammed when my car stalled. It usually happened after slowing down or stopping preparatory to making a turn and then accelerating to complete the turn. Usually the car was cold, but not always. It's enough to make you take the bus to feel the engine go dead while the guy behind is coming on inches away from your bumper. It's no less harrowing to know thousands and maybe millions of other drivers are going through the same experience. Detroit's getting unprecedented mail complaining about cars conking out.

Engineers blame the pollution control equipment, say stalling's only part of the problem. The antismoggers are also blamed for low gas mileage, hard starting in cold weather and lack of performance. No zip when you step on it.

The companies are expected to modify their '73s to ease the problem in hope of cutting down the complaints. GM, for example, is expected to cut compression ratios and make a change in the timing.

If the corrections don't work? See you on the bus!

★ ★ ★



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Simoniz® Vista Soft and Easy—for a good-looking, hard-wax shine. Painlessly.

Simoniz Vista Soft and Easy



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APPLIANCE CLINIC

By PAUL MANN

Dryer won't stop

We have a Kenmore 220-v. electric clothes dryer that won't shut off automatically. Until recently the timer knob would not run down to zero, but most of the time it would and the appliance would stop. Now, however, even though the timer knob does go to zero, the unit won't shut off—not even if I open the door. The only way I can get it to stop is by pulling the plug. Can you tell me what is wrong?—C.E. Bates, Jr., Wheeling, W. Va.

Ordinarily, this problem indicates an inoperative timer motor, a malfunction in the wiring that serves the timer or a switch that controls it. But don't overlook one other possibility. If you have the type of control that coordinates time and temperature, the timer is energized only when the heater is turned off by a thermostat. With such a unit, you can select one of several fabric designations (such as delicate, normal or heavy) on the dial. The machine will shut off automatically as soon as the clothes are dry. Failure of this type of control to stop a machine indicates a faulty thermostat as well as the other problems mentioned.

Dishwasher won't drain

I have a KitchenAid dishwasher (serial No. 57430—model No. KDI-15), and three servicemen have worked on it. After installation of two timers, a pump and a water valve the unit still will not let the water drain out. Water begins to drain on the last rinse cycle and then is shut off as the unit goes into the drying cycle before draining is completed. What is the solution?—Charles E. Murphy, Bellwood, Pa.

Perhaps you need plumbing service rather than appliance service. From an appliance standpoint I can't see what else can be done unless, of course, someone goofed and installed a wrong part.

It seems more likely to me that there's an obstruction in the drain system. Perhaps the drain hose or drainpipe is partially clogged, preventing complete drainage during the drainage cycle. Make sure that the drain hose is not kinked and has no sharp bends in it, and investigate the pos-

sibility of a blockage in the drain trap.

In this model, a short hose connects the drainpipe outlet and the drain valve inlet. This might be clogged, so have it disconnected and cleaned out.

Cold spot

Food items on the back shelf of my General Electric "all refrigerator" freeze up. Lowering the dial setting has not helped. Why does this happen and what can be done to correct it?—Dr. N. A. Newman, Lloyd Harbor, N.Y.

One good reason is a faulty temperature control. For example, the control has a bulb containing a temperature-sensitive substance. This bulb should be clamped firmly to the evaporator, because it's supposed to respond to the surface temperature of the evaporator. The bulb, in turn, allows a bellows to expand and contract, actuating the switch that starts and stops the compressor. If the bulb is loose, it may respond to the air temperature in the cabinet instead of to the evaporator temperature. There is a marked difference between the two. Have an authorized GE serviceman check this refrigerator.

All bound up

The motor of my American Standard garbage disposer will no longer rotate the cutters. The problem seems to be excessive friction, rather than electric trouble or jamming, since I can rotate the cutters with the wrench, but with some difficulty. Can this be corrected?—Charles R. Hodges, Frederick, Md.

This sounds like an electrical problem despite your thoughts to the contrary, but it's tough to troubleshoot this from afar since other things, such as bearings or jamming, may be the cause. Follow this procedure:

If the unit doesn't start and makes no sound, check that the reset button has tripped. To reset this protector, you may only need to depress the red button until it clicks and remains depressed. If this protective device has not tripped, the unit may have a defective protector or a broken connection through the run winding. If you have a lock-top model, there may be a defective switch.

If the unit doesn't start but makes a buzzing sound, test the turntable to see if it rotates freely. If not, chances are good that bearings have frozen and will have to be replaced. If the turntable rotates freely, there is probably a bad relay or broken connection through the start winding. If

(Please turn to page 50)

How to get away from everybody trying to get away from it all.

Millions of Americans crammed together in our cities and towns have made a discovery. The great outdoors. The trouble is they still usually end up elbow to jowl with their fellow man. But there is a way out.

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The Scout II can take you to places where ordinary vehicles can't follow you. You'd be surprised what the clean air and clear streams and golden quiet can do for your mind and spirit.

The Scout II has a practical side too. All

week long it works like a wagon—zipping around to the supermarket, station and school. It even has a fold down rear seat for extra toting room.

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Get 'em up Scout!

Scout II
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APPLIANCE CLINIC

(Continued from page 48)

you have a reversing model, the reversing switch may be defective.

One more thing—frequently overlooked. The cutters are stainless cast steel. Sometimes when not enough cold water is used in the grinding operation, small particles of food collect and tend to "freeze" the cutters. Turn off electrical current to the unit, force the food particles out from the cutters with a screwdriver and then wash the cutters with plenty of cold water.

Uptight upright

I recently inherited a Eureka upright vacuum cleaner from a relative. The machine is okay except that it vibrates. Is this something my husband can repair or should I consult a serviceman?—Mrs. John Sweeney, Fairfield, Conn.

That depends on the experience your husband has had in repairing vacuum cleaners. The degree of vibration will often provide a clue to the trouble. A slight vibration may indicate worn floor brush bearings. If the vibration is severe enough to shake the machine, the cause may be a broken fan. Between these extremes, you may feel a tingling sensation which can be caused by a bent armature shaft. The only remedy for these problems is replacement of the damaged part.

Maintenance Tips

● When splicing a line cord that's to be used in a damp area, make sure you pull the tape as tight as possible. Then spray the splice with a thin coat of acrylic plastic (sold at hardware stores). This treatment seals the tape and will make it as waterproof as possible.

● To start a nut in a spot you can't get your finger into, just stick some gum on the end of a wooden kitchen match and stick the nut to the gum. Carefully insert the nut in its hole and insert the screw from the other end, tightening it with your fingers. Then, pull off the match.

● Never use force when opening a plastic appliance case—you may break off the small molded studs around the edges. Gently pry around the seam of the case with a thin-bladed tool. ★★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.



The prima ballerina of the air.

You should see Mary J. Gaffney fly. Outside snaps and rolls, triple-amazing-whammies. At speeds up to 200 mph, and upside-down forces of 8 G's.

She says it's pure joy.

"I was going into my 40's and feeling kinda grumpy about it, when Curtis Pitt asked me to test his new plane . . .

that's this one here . . . and oh, boy, it was such fun. My friends say I'm crazy, but I just love it."

For the record, Mary J. Gaffney is the only American flyer ever to win a gold medal in international aerobatic competition. She is also the U.S. National Women's Champion.

We think she is a great, great lady.

And we can't possibly explain how proud we are that she shares our belief that Champions are the finest spark plugs in the world.



20 million people have switched to Champion Spark Plugs.

New compact airconditioner saves the view

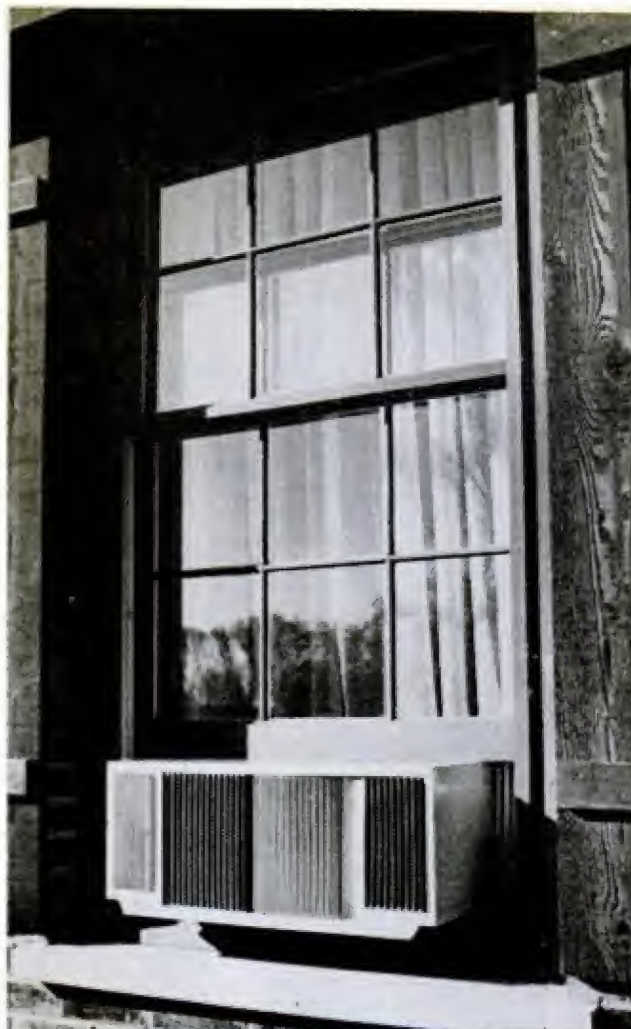
Most of today's airconditioners make a better "door" than "window." The exception is Sears' new 6000-B.T.U. Viewsaver. Measuring a mere 10 in. high, it is 20 percent smaller than others on the market, and it has several exclusive features. For one thing, this new compact bedroom-size unit leaves more window for you to see through. You can raise the window for washing without fear the unit will fall out, and with less than a 15-in. depth, it has less "hangover" to mar your home's looks and less protrusion inside to interfere with drapes.

What's more, its "Aware Conditioner" (an automatic thermostat control) lets you set it once and forget it for the season. It turns the unit on and off automatically—even its three-speed fan.

Quick-mount accordion side curtains eliminate the need to "build it in," and a simple locking device holds the center-balanced unit securely without help from the window. The unit uses 115-v. power, weighs less than 80 lbs. and sells for \$189.95.

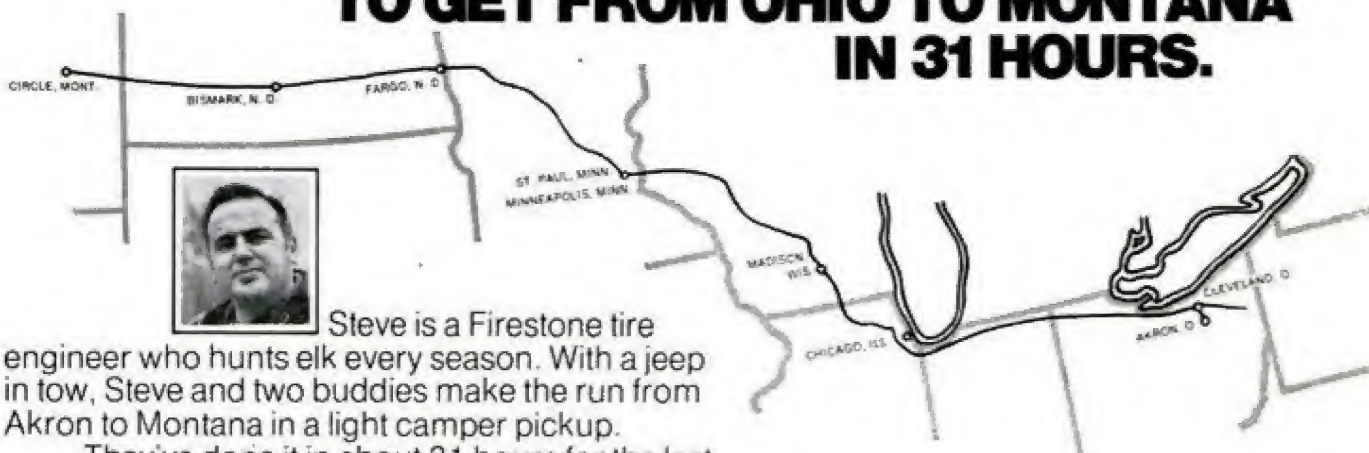
REVERSIBLE FRONT PANEL (right) has decorative cane finish on one side, burl elm on other, to give change of decor. Sliding panel conceals the controls

OLD VERSUS NEW (below) shows how much smaller new unit is than normal 16-in. monster. Rated cooling power for each model is the same: 6000 B.T.U.





STEVE PETRASEK HAS A SYSTEM TO GET FROM OHIO TO MONTANA IN 31 HOURS.



Steve is a Firestone tire engineer who hunts elk every season. With a jeep in tow, Steve and two buddies make the run from Akron to Montana in a light camper pickup.

They've done it in about 31 hours for the last nine years. Because they've systemized things down to the last spare bolt: Two-hour driving shifts, fuel records, and food and gear allotments figured to the final fresh egg.

The tires they'll be using next season are a natural part of this computer-like approach.

Firestone's Wide Oval Tire System for campers. Here's how it works:

On the front, you put Firestone's Transport 500 Wide Oval® truck tires. They're the *steering* part of The System. They have a wide, wide tread that grips the road to deliver more mileage under normal conditions than the tires they replaced in our line. (The Transport Wide Oval.)



On the rear, you put Firestone's Traction All Season™ Wide Oval™ truck tires. They're the *drive* part of The System. Their computer-designed tread lets you run along at turnpike speeds, then pull off the road (even into snow or mud or sand) and keep on going.

Two pairs of Firestone tires teamed together to provide your camper with stability, traction, and long tire life.

They work! Take it from Steve (write to him C/O Firestone, Akron, Ohio 44317 for more information). Or ask your local Firestone Dealer, the man with The System.

The Wide Oval Tire System
for Campers.

Firestone

PM's test with decibel meter and rough rider shows that Bultaco has broken the noise barrier with its new Alpina—and it's surefooted to boot!

MOTORCYCLE NOISE can be the most irritating sound anywhere, and when that noise is generated out in the woods or desert it becomes even more obnoxious. Just how noisy competition-bred two-cycle can be is illustrated by the fact that on several occasions I have heard motorcycles over five miles across the Viccaino Desert! I'm a motorcycle fan and didn't enjoy the experience at all.

The engineers at the Bultaco factory in Barcelona are fully aware of this problem, and so have devoted a great deal of care and ingenuity to silencing their new off-road bike, the Alpina. They have succeeded so well that I couldn't hear the engine, at idle, a hundred feet away. Up close the whirr of the gears was plainly apparent, something I'd never before noticed on a two-stroke machine because of the exhaust noise.

The usual two-cycle motorcycle engine gets most of its power from a tuned exhaust system that is inherently noisy in itself. It cannot be muffled and still have the engine put out maximum power. With tuned exhausts designers have been able to obtain an awesome amount of power from very small engines using very narrow power band, at the expense of creating an ear-shattering racket.

The Bultaco people went at the problem the other way around: By using a relatively large 250-cc engine, they were able to eliminate the tuned exhaust requirement for obtaining sufficient power for a go-anywhere trail bike, and they could concentrate on designing a compact and practical exhaust muffling system.

They used a large-diameter exhaust pipe leading from

At last, a powerful and quiet bike for the trail!



AUTHOR makes quick work of a steep hill in a recent enduro competition

By DOUG RICHMOND
Photo by Danny MacMurray

the cylinder to the first muffler to cut down gas velocity. The pipe itself is connected to the primary muffler with a synthetic rubber sleeve. The primary muffler is coupled to a second smaller muffler by another rubber sleeve.

Two mufflers are used because it is extremely difficult to obtain efficient sound dampening over a wide frequency range with a single unit of reasonable size. The approach is not new, but Bultaco is the only manufacturer who applies it to cycles.

Since the engine is large enough to develop ample power without resorting to exhaust tuning, it could be designed with a very wide power band. It's basically a simple, four-port, two-cycle design. Extra weight was added to the flywheel to smooth the power impulses at low speed. For low-speed tractability, the carburetor is 27 mm—about the size one would expect to find on a 125-cc machine.

The result of all the hot-rodding in reverse is an engine with a rated horsepower about the same as for a hot machine

of half the displacement, with absolutely no signs of temperament, easy starting and the ability to pull strongly from walking speeds up. And it idles like an old-fashioned farm engine with a steady chug, chug, chug without a bit of loading-up.

The foot pegs are set much more to the rear than on most trail bikes to facilitate riding in a standing position, and the tank is made extremely narrow to allow the machine to be shifted readily from side to side beneath the rider. A tank of this design necessarily has small fuel capacity, and on the Alpina the capacity was increased by extending the tank back under the seat itself.

The seat has less padding than the usual run of trail cycles but the Alpina is intended to be ridden standing on the pegs in rough spots and the seat used for smooth sections.

Foot pegs and rear brake pedal are made of serrated steel with cutouts to allow them to clear themselves of mud, and

(Please turn to page 56)

BULTACO ALPINA SPECIFICATIONS

Bultaco, Box 433, Silverado, Calif. 92676.
Recommended retail price: \$895 p.o.e.

Tires: Front—2.75x21 knobby
Rear—4.00x18 knobby

Rims: Alloy

Engine: Type—piston-port, 250-cc, 2-cycle single
Bore and stroke—72x60-mm (2.83x2.36 in.)
Compression ratio—(swept) 9:1
Carburetor—27-mm Spanish Amal
Power—19.8 hp @ 5500 rpm
Lubrication—Oil in fuel

Fuel capacity: Approximately 2.6 gallons

Transmission: 5-speed, foot shift on right.
Ratios—(1) 25.75:1; (2) 17.4:1;
(3) 11.3:1; (4) 9.7:1; (5) 8.8:1

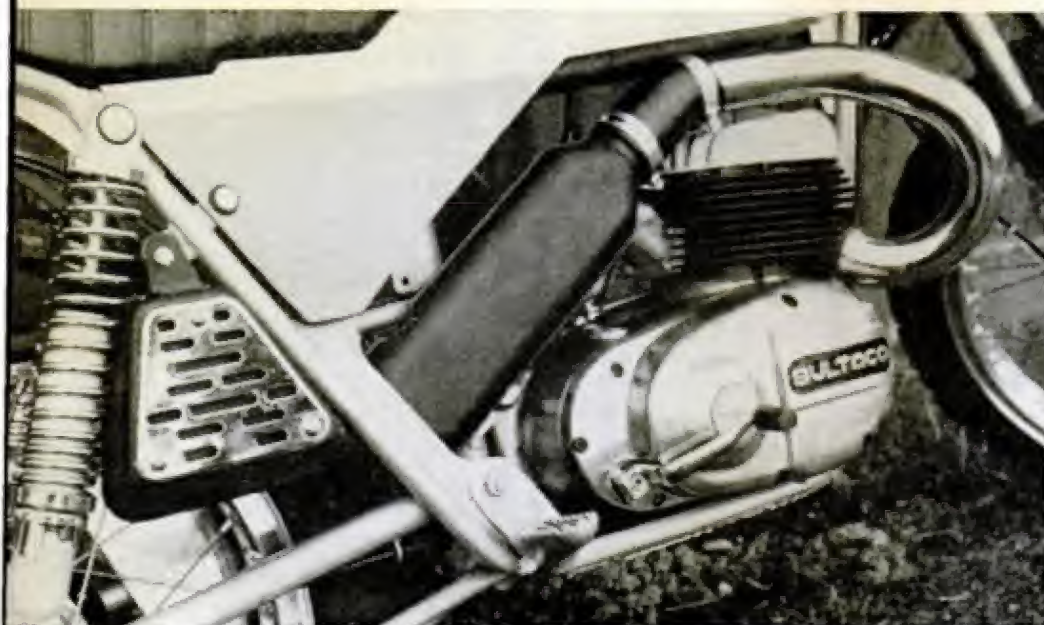
Frame: Wheelbase—52.5 in.
Ground clearance—11 in.
Weight, with fuel—220 lbs.
Seat height—31 in.

Noise level: 78.2 db (average of five runs). Sound measured 50 ft. from lane of travel with bike running at steady 40 mph.

Lights are supplied boxed for the user to install if he desires. Toolkit supplied as a waist pouch to be worn by the rider.

LARGE-DIAMETER EXHAUST PIPE, which slows exhaust velocity, marks Alpina profile





UNTUNED EXHAUST from the 250 single keeps down noise. Primary and secondary mufflers are connected by synthetic rubber sleeves. The exhaust is vented to atmosphere near the rear wheel through a short length of $\frac{7}{8}$ -inch pipe. Noise reading of 78.2 decibels (db) was obtained by running bike on gravel instead of pavement to minimize the noise of the knobby tires. Readings taken on two tuned-exhaust machines for comparison were 82 db for a 100-cc model and 90 db for a 250-cc bike. Antinoise bills pending in legislatures of many states would set maximum db levels for both street and trail bikes

QUIET BIKE FOR THE TRAIL!

(Continued from page 55)

there is a large opening in the transmission case to prevent any mud buildup and to facilitate threading a drive chain, something that can be quite a hassle with most bikes.

A spring-loaded chain tensioner is used on the rear chain to make chain adjustment

a bit less critical and to cut down jerking from power impulses at low speeds. As a secondary benefit it serves as a guide and helps prevent the chain from jumping the rear sprocket.

Gear ratios were chosen with extremely rough country in mind, and low is a real stump-puller. There is quite a long jump to second, but from second on the gears follow in fairly regular procession. Top speed in fifth is over 70 mph. The gear changes are sure and easy—we never missed a shift on the Alpina, and neutral was easy to locate.

The forks have $6\frac{3}{4}$ inches of travel and are damped in both directions. Rear suspension is five-way adjustable and allows four-inch movement at the rear axle. All suspension springs are progressively wound and the springs on the shocks are chromed.

Clutch is the usual multiple-disc, oil-bath unit and is the equal in performance and ease of operation of any we have used.

Handlebars on the Alpina are fantastically wide, 34-inchers, great for a stand-and-ride configuration. If you prefer fast riding to precise riding, there are narrower bars available as an option.

Riding the Alpina we found no flat spots anywhere in the throttle response, and it wasn't necessary to charge up every steep pitch in order to stay in the engine's usable power band as we've learned to do with other bikes. As long as the Alpina's engine is turning it will pull!

When we first inspected the bike we were a little suspicious of the modest—by today's off-road standards—ground clear-

(Please turn to page 58)



ON ROCKY HILLSIDES and creek beds Alpina proved itself repeatedly. Torque in low gears is impressive

The principle is the same. The potential is different.



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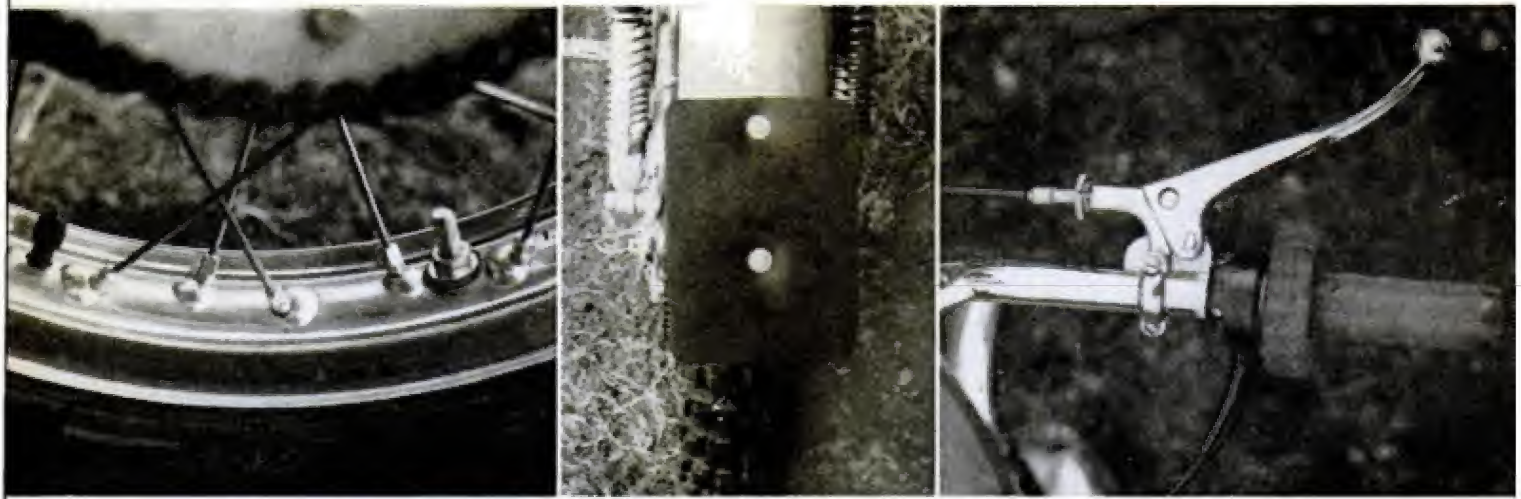
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SECURITY BOLTS on tire rim, left, prevent tire from turning on rim. Tube stem has no retaining nut so it won't be jerked out of tube in case of flat. Rubber flap, center, keeps mud off rider's back. Control lever, right, is steel. Sponge-rubber pad is easy on throttle hand. Rubber boot over cable end keeps out dirt



CHAIN TENSIONER is spring-loaded, reduces chain wear and contributes to easy handling at low speeds



JUNCTION BLOCK makes installation of lights easy. Lights are supplied with bike but they're in a box!

QUIET BIKE FOR THE TRAIL!

(Continued from page 56)

ance of just under a foot, but riding we discovered that we could simply tweak the throttle a bit and loft the front wheel over obstacles, and this got us over obstacles higher than the measured ground clearance.

The best test of a bike's suspension and handling is its ability to negotiate rocks, and in this the Alpina has no near rival in the trail-bike field. We rode it for hours in



CUTOUTS around the drive chain allow mud to escape; foot pegs and brake lever are also mud-free

creek beds and on rocky hillsides just for the fun of being able to ride in places where we could only walk with difficulty!

A big, strong rider can do things with a trail bike that a smaller man will find impossible, so for our test we enlisted the services of Danny MacMurry who is five-feet-four and tips the beam at 112 pounds. He has been riding a 100-cc machine, but he made the transition to the more powerful bike like a duck to water. Partially this was because the Alpina has a seat height about the same as most 100-cc cycles, and partially because the handling characteristics make it possible to ride this bike instead of muscling it over the countryside.

The Alpina will not be everyone's cup of tea, but for the man who wants the ultimate in trail-bike handling, who regards every piece of tough terrain as a personal challenge, it is worthy of serious consideration. For the dyed-in-the-wool enduro competitor it's a natural! ★★



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knocks out the electricity for awhile. Why McCulloch is better than anybody. Not all current is current. Old-fashioned conventional generators can be a pain. They have brushes and slip rings that wear out. Electromagnets that can overheat. Things that can make them arc or spark or short out. McCulloch is more than current. It's a little science-fiction-y! It has a truly unique design—with only one moving part. Virtually nothing to wear out. McCulloch gives you the most reliable portable power you can buy.

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McCulloch Corporation, Los Angeles, Calif. 90045

*Manufacturers suggested list price.

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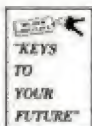
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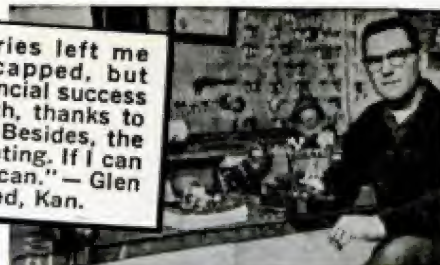


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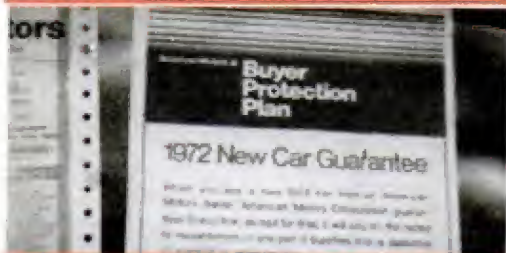
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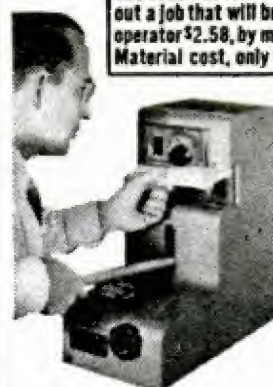
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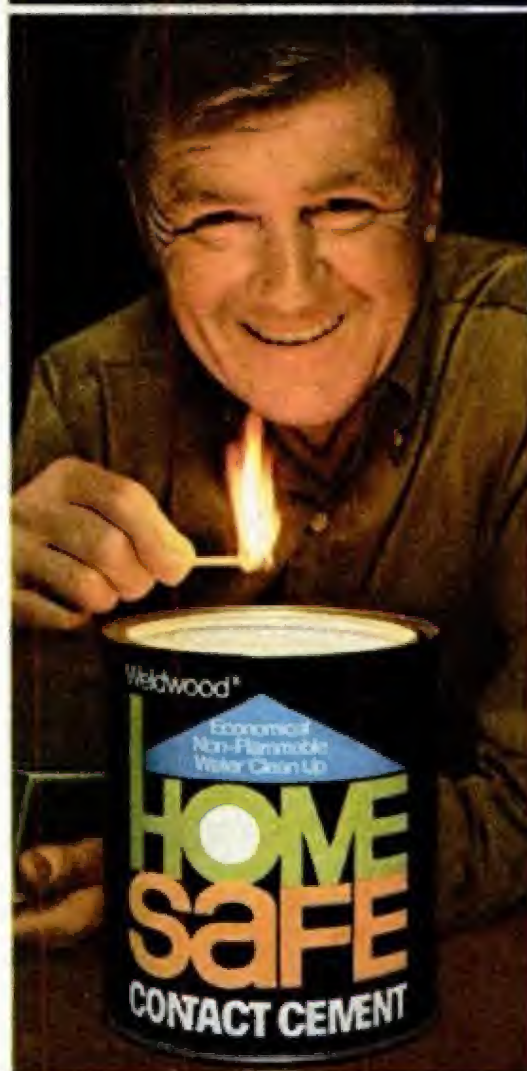
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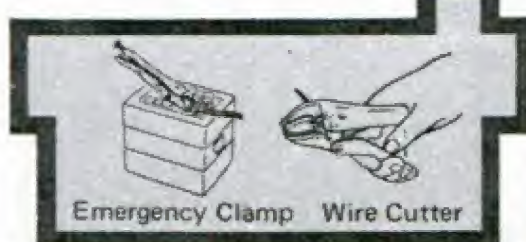
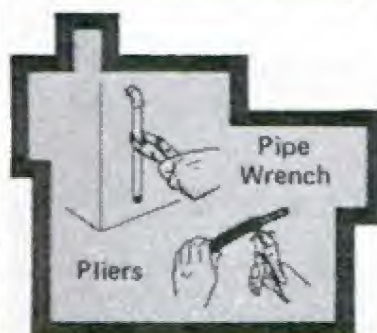


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'72 Road Racing Preview:

One for the money! Two for the show!

Ready to go, side-by-side into
turn one in the Can-Am battle



for bucks is
America's best
road racer, Mark
Donohue, and the

world's best,
Jackie Stewart! If that's not
enough action, the United States
becomes the first
country ever to
run two Grand
Prix races!

Photo by
Richard George



By **BILL HARTFORD**, Auto Editor

DRIVING AT THE LIMIT is what auto racing is all about. And hanging onto a strip of twisting asphalt as it caroms off to the left and then drops out of sight to the right is what road racing is all about.

Getting around a road circuit fast takes as much brawn as it does extraordinary balance—accelerating, shutting off, hard braking, dozens of gear shifts, clipping the corners close and every lap at the car's limit of adhesion.

In the sport, the measure of man and machine is lap time. Before the ultimate test—competition with other cars and drivers—a road racer has to beat the clock.

That's just what happened earlier this year on a quiet day at Road Atlanta. There, with no one watching, during practice for the '72 Canadian-American Challenge Cup, the lap record was broken.

The driver: Last year's Trans-Am champ,



Photo by Richard George

a mechanical engineer who knows cars inside and out and doesn't like to waste his time on a loser. Mark Donohue. The car: Test configuration of a new car from the marque that's taken the World Manufacturers' Championship the last three years straight. Porsche.

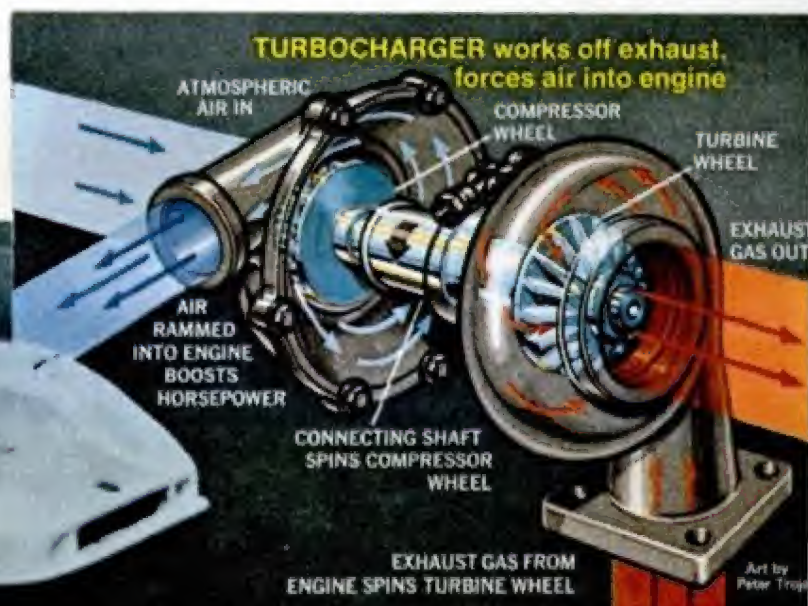
When Mark qualifies the Roger Penske-prepared, factory-backed Porsche for the first Can-Am at Mosport, he'll be shooting to end the McLaren domination of the series. That, hard as it is to imagine, makes Donohue the underdog. It'll be hard for this ace to beat the Can-Am kings.

Last year Peter Revson and Denny Hulme took all the chips in the Sports Car Club of America's premier road-

UNIQUE ROAD RACE at Ontario Motor Speedway last year pitted International Formula 1 against United States Formula A/5000. Mario Andretti won

racing series. It was another year of orange monotony in the Can-Am. Another year in which the competition fizzled and failed to put a fresh color in the winners' circle. Even Jackie Stewart, the Formula One world driving champion, couldn't stop them. He did win two races in his Lola Chevrolet but since he couldn't beat 'em, he joined 'em! So, the McLaren Can-Am team for '72 is Denny Hulme, world driving champ in '67, and Jackie Stewart, ditto for 1969 and '71. (Peter Revson scooped up his 1971 Can-Am Cup and dashed off to race a McLaren car on the Grand Prix circuit.)

PORSCHE THREAT to McLaren will come from Mark Donohue in first turbocharged road racer. Flat 12 will get big boost in hp if tests are successful and principle (right) can be applied to road-racing car which must have quicker throttle response than usual with turbocharger





U.S. GRAND PRIX RACES

Apr. 9 Riverside Oct. 8 Watkins Glen

SCCA CAN-AM CHALLENGE CUP

June 11 Mosport	Aug. 27 Elkhart Lake
June 25 Open	Sept. 17 Donnybrooke
July 9 Road Atlanta	Oct. 1 Edmonton
July 23 Watkins Glen	Oct. 15 Laguna Seca
Aug. 6 Mid-Ohio	Oct. 29 Riverside

in a 12-cylinder F1 Ferrari. Here, cars coming out of the turn are No. 30, Sam Posey, FA Surtees; 25, John Cannon, F1 STP-March; 15, Howden Ganley, F1 BRM

Mark will be looking to run one of the McLarens out of the front row, and he won't be running scared. When he broke the track record at Road Atlanta (118.57 mph), he was only testing the Porsche chassis, not even running with the turbocharger that is under development for the engine. If the flat, 12-cylinder engine runs turbocharged, the Porsche will have a horsepower edge on the normally aspirated Chevy V8s in the McLaren cars. But, at this writing (mid-January), work continues toward improving throttle response of a turbocharged engine.

This is especially critical in road

PHOTO BY BILL HARTFORD →



READY TO RACE at Monaco, young F2 champ Ronnie Peterson, confers with team. He piloted the F1 STP-March to second place in the Grand Prix on the streets of Monaco last year, was second in World Drivers' Championship. At the left is the new '72 car for this driver-to-watch

racing where quick throttle response coming out of corners is essential. In oval track racing, at Indy for example, drivers are touching their brakes for control going through turn four while at the same time putting their foot down on the throttle to wind up the

SCCA TRANS-AMERICAN CHAMPIONSHIP*

May 6—Lime Rock, Conn.
 May 29—Bryar Motorsport Park, Loudon, N.H.
 June 4—Mid-Ohio Sports Car Course, Lexington, Ohio
 June 18—Watkins Glen, N.Y.
 July 4—Donnybrooke, Brainerd, Minn.
 July 16—Road America, Elkhart Lake, Wis.
 July 30—Open
 Aug. 13—Mosport Park, Bowmanville, Ont.
 Aug. 20—Summit Point Speedway, Summit Point, W.Va.
 Sept. 3—Edmonton International Speedway, Edmonton, Alta.
 Oct. 29—Riverside International Raceway, Riverside, Calif.

*On weekend programs with all Trans-Am races in the United States are Two-Five Challenge Series races, with additional Two-Five at Laguna Seca Oct. 14-15.

turbocharger and build up power for the blast down the main straight.

Turbocharging is nothing new on the oval circuits, but would be a new and exciting breakthrough if Porsche introduces it to road racing.

On the Grand Prix circuit, the United States' only full-time representative is hard-charger Peter Revson. Not since Dan Gurney retired back in 1967 has an American driver campaigned the full schedule of world road races. (Date conflicts with his USAC schedule keep Mario Andretti from starting all the Grand Prix races.)

Revson will run all the Grand Prix races (with team-leader Hulme) and he'll be running two of them in the United States. "Impossible!" would have been the race fans' reaction to this last year. But this year the United States becomes the first country ever to get exception to the one-to-a-country rule. Watkins Glen is, as usual,

NOTE: As PM goes to press, the Grand Prix at Riverside is unsponsored and meetings are in session to determine if a year's postponement of the race will be necessary.

host to the Grand Prix East, with the traditional October date, the 8th this year (See *The Wildest Show on the Road!*, page 80, Sept. '68 PM). And for the first time, on April 9th, the U.S. Grand Prix West will run at Riverside International Raceway.

In his McLaren Ford, Revson will find himself up against much stronger competition than he faced in the Can-Am. For one thing, McLaren cars have been outstanding in Can-Am, but those designed for F1 have been just so-so. (Cars this year are white, black and brown, because of sponsorship by Yardley, the British perfumers who backed BRM last year.) Also, in Can-Am you can count the potential winners on one hand, but in F1 there is intense competition among almost a dozen high-flying pilots.

Still, Revson is not a newcomer: He had his first F1 ride in a Lotus in '63, won an F3 race at Monaco in '65, and has earned a good number of points in every type of road racing from the Manufacturers' Championship to the Trans-Am series. But he's up against the incredible talent of Grand Prix drivers like Jackie Stewart, who's defending his world title as well as running Can-Am. Then there's Ronnie Peterson, the extremely fast 28-year-old Swedish driver who roared onto the F1 scene right from F3—the first driver to make such a debut skipping Formula 2—and who last year raced Formula 2, won the championship, and placed second to Stewart for the world title in F1. We saw him start

SCCA CONTINENTAL 5000 CHAMPIONSHIP

May 7—Laguna Seca, Monterey, Calif.
 May 21—Seattle International Raceway, Kent, Wash.
 June 4—Edmonton International Speedway, Edmonton, Alta.
 June 18—Watkins Glen, N.Y.
 July 16—Road America, Elkhart Lake, Wis.
 July 30—Donnybrooke, Brainerd, Minn.
 Aug. 20—Road Atlanta, Gainesville, Ga.
 Sept. 4—Lime Rock, Conn.
 Sept. 24—Riverside International Raceway, Riverside, Calif.

eighth on the grid at Monaco last year and pass drivers many years his senior in Grand Prix experience to finish second to Stewart by 25.6 seconds! He was always in superb control of the STP-March racer and this year in his new March 721 (see page 77) should be an even greater threat to the "old-timers."

You can hardly call Jackie Ickx an "old-timer," except in GP experience, that is! Round out the grid with drivers like Cevert, Fittipaldi, Regazzoni, Amon and his own teammate, Denny Hulme, and you know that red-white-and-blue Revson has a long, hard season ahead. Perhaps he can make a

mark in world road racing and join only a handful of American road racers, including, of course, Dan Gurney, who has won more Grands Prix than any other American driver.

The expense of campaigning on the Grand Prix circuit is the reason Dan retired from international road racing. For one reason or another, American drivers have not been a force in Grand Prix racing despite the long and colorful history of road racing in the United States—going back to the turn of the century.

The establishment of the Can-Am series in 1966 and the second United

(Please turn to page 206)

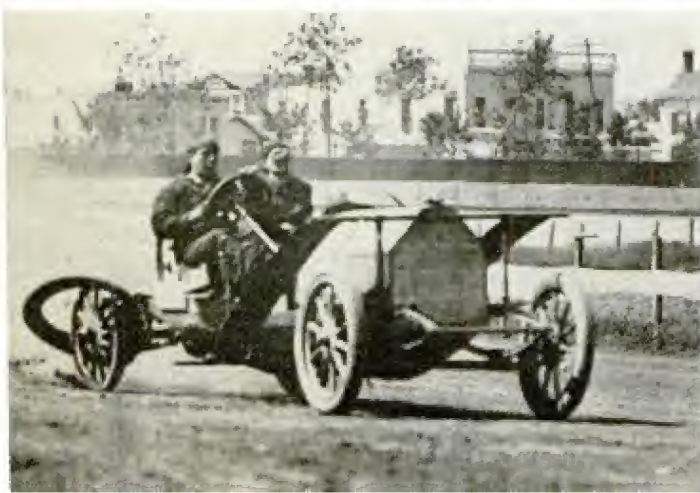
... and racing in the good ol' days!



AH, THE DUST AND THE GLORY! Circa 1910 there was no problem in choosing the right hardness or softness of tire compound and no choice of tread for racing in the rain; there was just the monumental problem of keeping the tires and wheels on the cars! Drivers had all they could do to hold the machines on course and the mechanics, who had to go along for the ride, were too busy pumping oil to the engine and keeping things together to even be



scared. When these pictures were taken at Brighton Beach, N.Y., by photographer Otto Klingmann, motor racing in the United States was already over 10 years old. The Vanderbilt Cup on Long Island was America's premier race and road racing was enjoying its first golden years. It was a great age when iron men on wooden wheels dared to go faster and faster to find out more and more about vehicle dynamics. The races you watch in 1972 started here!





The superfast spy plane we don't talk about

The "blackbird" is said to fly at 3000 mph and hit altitudes of 20 miles. For years it has snooped on Red China, monitoring almost every nuclear test behind the Bamboo Curtain

By EDWARD HYMOFF

ASK AN AVIATION BUFF about the SR-71 and he'll probably know that this Mach-3 aircraft exists. But ask him for specifics and he'll surely draw a blank. The same holds even for government agencies on whose behalf this fast spy plane flies its lonely—and dangerous—missions through hostile skies.

For years Communist China and the Soviet Union have been trying to shoot one down—without success. The SR-71—successor to the successful but ultimately ill-fated U-2 spy plane—is the fastest recon aircraft in the world.

POPULAR MECHANICS



AIR FORCE VERSION OF THE SR-71—called the YF-12—is refueled by big tanker. Designed to function as an interceptor, the plane reportedly proved too fast for combat, where maneuverability is important

With afterburners and boosters on full, the SR-71 has been clocked at more than 3000 mph—too fast for the human eye to find and fix, and an elusive target even for radar.

The SR-71 came into the news last summer at a time when our government was attempting to improve its relations with Communist China. One news story leaked the information that the United States had halted all flights of reconnaissance planes over China and referred to the mysterious SR-71.

It was apparent that President Nixon wanted to avoid the kind of situation that arose when, in 1960, Francis Gary Powers was downed over the Soviet Union in a U-2 spy plane. The Russians angrily canceled a planned summit meeting and President Eisen-

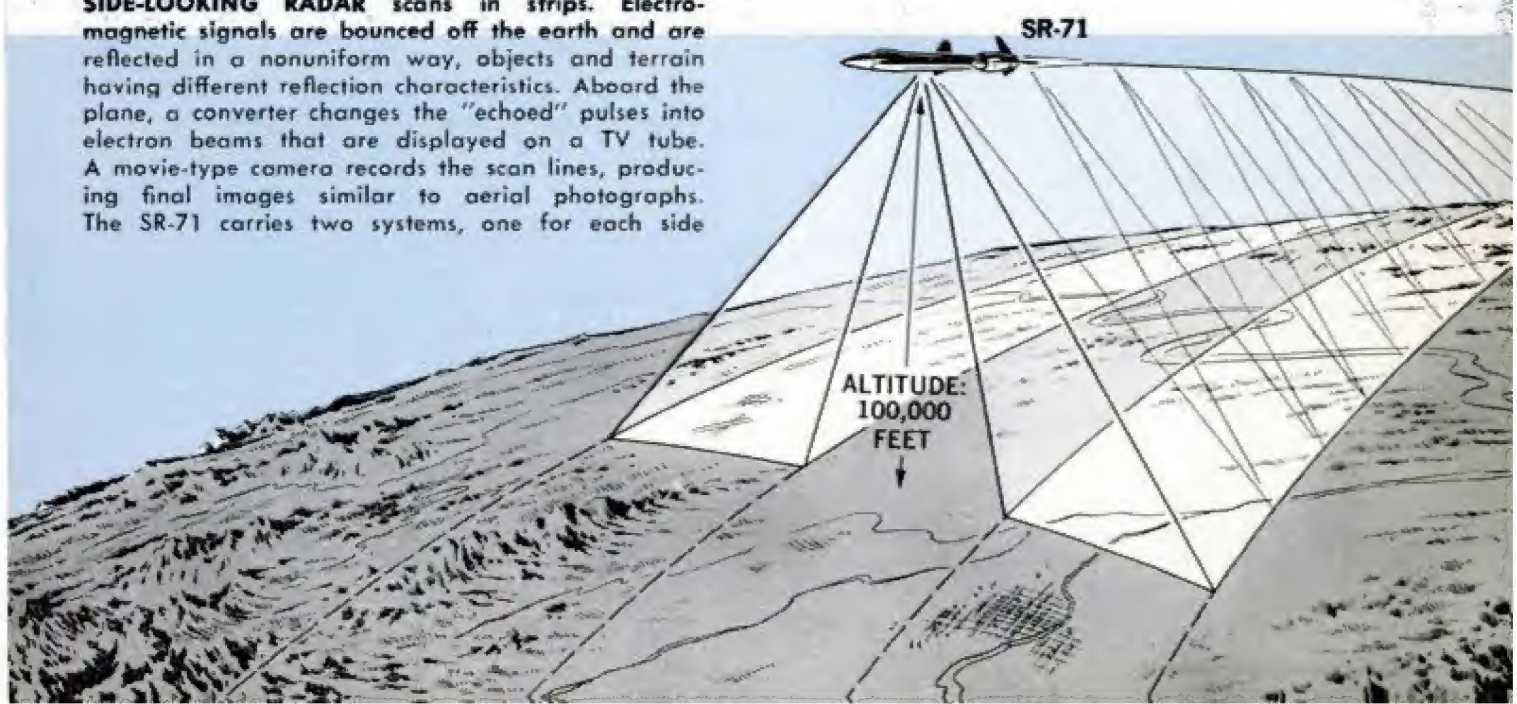
hower was left with egg on his face.

But the halting of China overflights doesn't mean that America's superspy plane is grounded. There are other recon missions for these swift planes.

Even at this moment a teletype message may be clattering across the Pentagon's global communications network advising the Strategic Air Command to prepare a spy plane for a recon mission. At a base on the U.S. West Coast a long black bird with stubby wings is prepared for flight.

Meanwhile, in one corner of the sprawling SAC base on the island of Guam, a third of a world away, a bustle of activity is triggered by a priority message received at the island's underground communications center: **PREPARE FOR BLACKBIRD ARRIVAL AND FLIGHT**

SIDE-LOOKING RADAR scans in strips. Electromagnetic signals are bounced off the earth and are reflected in a nonuniform way, objects and terrain having different reflection characteristics. Aboard the plane, a converter changes the "echoed" pulses into electron beams that are displayed on a TV tube. A movie-type camera records the scan lines, producing final images similar to aerial photographs. The SR-71 carries two systems, one for each side



OPERATIONS. Civilian employees in a heavily guarded building begin working 'round the clock. Word quickly spreads, despite the secrecy, that "the bird" is due to arrive.

During the past seven years the bird has come and gone many times from Guam. Each trip has served to anger Communist leaders in Peking. For example, the SR-71 on a number of occasions has flown high over the rugged terrain of remote Sinkiang Province and its two-man crew has observed the test blasts of Peking's nuclear weapons—both A-bombs and the far more complex thermonuclear H-bombs.

The bird's exact specifications are still cloaked in secrecy. Official publications describe an aircraft with a wingspan of "approximately 55 feet," a length of "approximately 107 feet," standing "approximately 18 feet high" from the ground to the top of twin vertical fins or rudders. It is powered by two Pratt & Whitney J-58 engines of "about 35,000 pounds thrust each" and at Mach 3 it flies at more than 2000 mph, or slightly faster than a 30.06 rifle bullet. Finally, the SR-71 is reported to fly "above 80,000 feet" and has the ability to "survey 60,000 square miles in an hour."

Unofficially, it weighs in at between 75 and 100 tons, depending upon the mission and fuel load, and is usually refueled in skies well outside the boundaries of the nation where the target is located. On the return flight, the plane is refueled in flight as many times as necessary to reach the nearest

airstrip capable of accommodating the lengthy landing roll. Even so, a huge parachute is used for braking.

Exact performance data is top secret and known only to the two-man crews, maintenance personnel, senior engineers at Lockheed Aircraft Corp., and a small number of Air Force officers and Central Intelligence Agency operations people. But hostile observers have a good idea what the plane can do. It's a safe guess that both Soviet and Red Chinese radar operators have reported that the bird has been monitored at altitudes of 20 miles and at sustained speeds in excess of 3000 mph across distances of 5000 miles.

To date, the bird is still considered one of the nation's major military secrets. However, it's no secret that a squadron of these aircraft is assigned to the 4200th Strategic Reconnaissance Wing, a SAC unit based at Beale Air Force Base in California. Pilots and RSOs (Reconnaissance System Officers) assigned to this SAC wing are virtual mystery men continuously on the move in their black aircraft.

The SR-71 proved its capabilities on May 9, 1966, when Communist China exploded its third A-bomb. The event was monitored from start to finish by two Americans in a spy plane more than 20 miles high and close enough to the test site to "see all" and "hear all." Nearly six years ago this specially trained two-man crew climbed into one of the twin-ruddered SR-71s at Beale AFB and thundered west on a course for Guam. The blackbird was met three



U-2

LOCKHEED AIRCRAFT PHOTO

DIFFERENCE IN APPEARANCE of our two spy planes is striking. The U-2 (left) resembles a glider, but the SR-71 almost has the look of a rocket. Designed in the '50s, the U-2 has extremely long wings to provide lift at high altitudes and a jet engine built for endurance rather than speed. The plane flew so

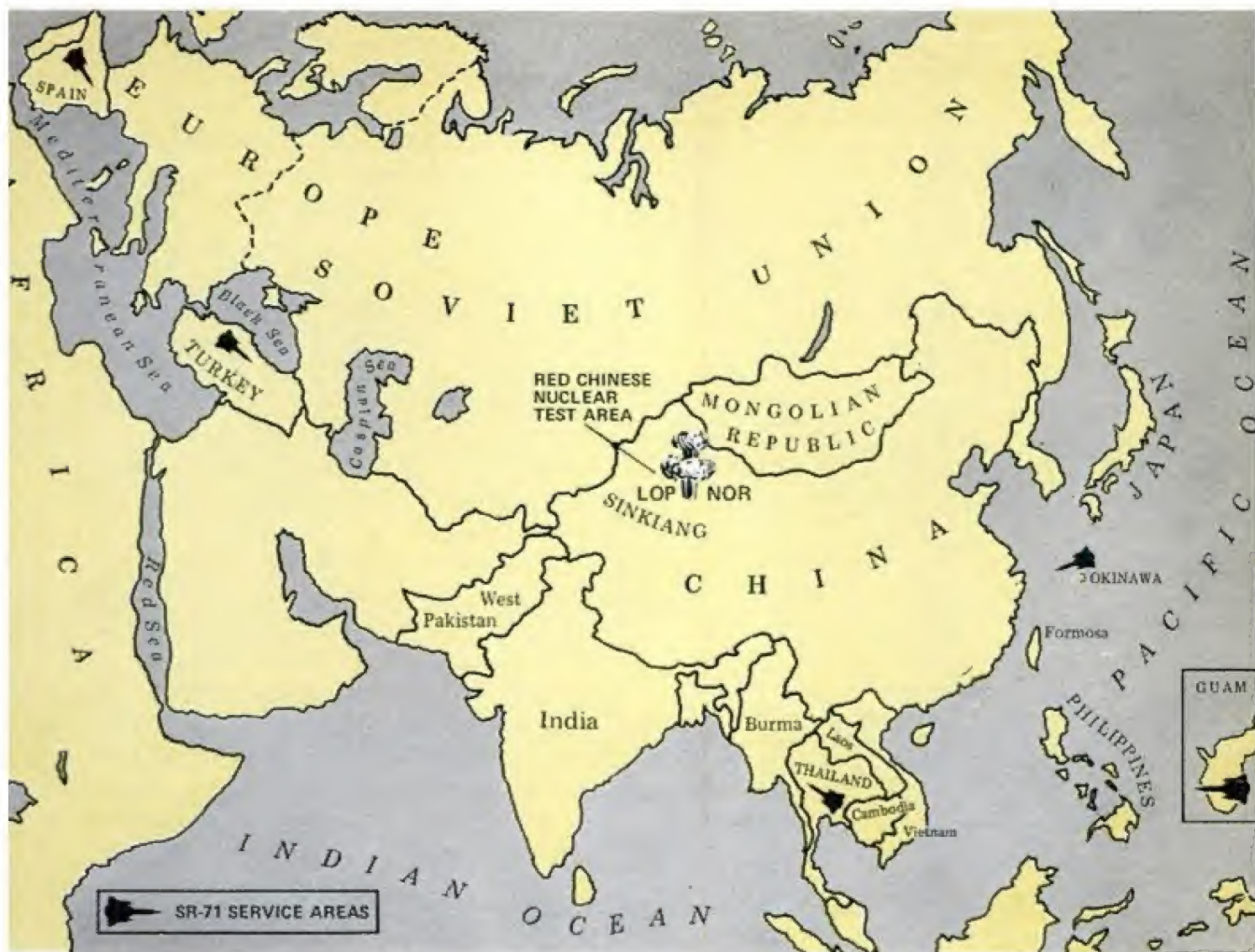
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SR-71

high that for years neither enemy interceptors nor missiles could touch it. The SR-71 was given other capabilities. Though its wings are stubby—permitting greater speed—it has two powerful jet engines that can push it to altitudes of 100,000 feet, according to some sources. Its speed is over Mach 3

POPULAR MECHANICS



MAP BY GERHARD RICHTER

FAST-FLYING SR-71s EAT UP THE MILES on overflight missions in many parts of the world. In addition to keeping an eye on China, the planes have done surveillance work in Vietnam and, reportedly, in Mideast

times by KC-135 tankers, slowing down from a 1600-mph cruising speed to the near-glide required to nuzzle up to the lumbering jet tankers.

It landed at Guam nearly four hours and 5250 miles later. Slowly, the SR-71 taxied to the off-limits group of buildings surrounded by guards, sentry dogs and electric fences. For the next two days the pilot and RSO were briefed by representatives of the CIA and the Atomic Energy Commission. Wall maps of the Lop Nor area and blow-up photographs of the Red Chinese nuclear testing site were studied.

"We expect the device to be detonated in three days," the CIA's senior official advised the pilot and RSO. "We want to be right there when it's fired."

The pilot and RSO studied the area over which they would fly. They would

have to be on station 50 miles from the target in time to throttle up for one pass through the mushroom cloud so that delicate sensors mounted in the stubby wings could pick up samples of radioactive debris. It was imperative that one question be answered: Had China exploded a thermonuclear weapon—an H-bomb—or a conventional A-bomb?

On May 9, a few hours before the scheduled blast, the long black plane streaked westward toward a target 4500 miles away and deep inside hostile territory. On the way the blackbird met KC-135 tankers. At the final refueling point near hostile borders, Red Chinese radar operators couldn't help but sight the fast-moving blip on scopes. They reported their observations and

(Please turn to page 192)

They caught a falling star

By JAMES CORNELL

The rock from space trailed fire as it hit Earth's atmosphere at 25,000 mph. It angled toward America . . . toward Connecticut . . . toward a house in a town called Wethersfield

It happened just a year ago. Around 4:00 a. m. on April 8, 1971, a gigantic fireball streaked over Hartford, Conn., trailing dust, smoke and sonic booms. It was a supereconomy-size shooting star produced by a chunk of cosmic debris entering the atmosphere.

An estimated 1 million tons of such stuff, including what astronomers think may be bits of minor planets and the remains of disintegrated comets, fall on Earth each year. Most of it is in the form of a fine black dust that readily mixes with industrial particles and other pollutants. Slightly larger pieces produce the tiny falling stars seen briefly on a summer's night.

But occasionally much larger pieces survive the fiery plunge through the atmosphere and fall to Earth intact. These rare hunks of stone and metal, called meteorites, were man's only samples of matter from space prior to Apollo 11, when the first moon rocks were brought to Earth.

About two hours after the fireball blazed across the sky over Hartford, a man in nearby Wethersfield noticed a hole in the ceiling of his living room. Paul J. Cassarino, a 61-year-old machinist, climbed up on a chair and reached a hand into the hole.

"Almost as soon as I did," he recalls, "a little rock fell out. It was black and smooth and very heavy for its size."

Investigation revealed that the rock had ripped through the roof shingles, and penetrated a layer of three-quarter-inch plywood and four inches of insulation before lodging in the half-inch-thick plasterboard ceiling.

It clearly wasn't a case of vandalism. "This has to be something special," thought Cassarino. "The rock must have fallen out of the sky—maybe from an airplane."



But he had no time to pursue the problem. He had to get to work. Before he left he told his wife to call the police or the fire department.

Mrs. Cassarino called the police. The first officers on the scene confirmed the opinion that the damage had not been the work of vandals. They called their captain for instructions and he, in turn, contacted the Board of Health.

Meanwhile, the fire department arrived. Soon the street was filled with squad cars, fire trucks and curious on-lookers.

In time the gathered officials arrived at a consensus: The mysterious stone in the Cassarino living room was a meteorite, most likely the same one that had created the fireball and sonic booms over Hartford only hours before.

The 13-ounce gumdrop-shaped stone probably had been 10 times larger when it began its long voyage to Earth millions of years ago. When its orbit crossed Earth's, it was captured by the planet's gravity. Hitting the atmosphere 60 miles above Hartford while speeding at 25,000 mph, the rock generated enough heat to cause surrounding gases to glow and burn. The shock of entry also sent chips of stone flaking off to swirl away in the upper atmosphere.

The fireball went out when the meteorite was some five miles above the ground. Thicker air had slowed the rock, so that friction no longer ignited the gases. But the object still moved fast enough to break the sound barrier.

The odds against this meteorite striking a house were tremendous; there are no more than a dozen recorded instances of a falling star hitting a building. The Cassarinos really had something to crow about.

Their excitement was matched by



THE METEORITE RIPPED through roof shingles, a layer of three-quarter-inch plywood and four inches of insulation before punching a hole in the ceiling



SHINY BLACK ROCK was 10 times this size, say scientists, when it started long journey to Earth



that of scientists, for the occurrence provided a rare opportunity to examine a space rock while it was still "fresh." Meteorites are radioactive because of bombardment by cosmic rays, but the radioactivity is weak (far below harmful levels) and begins to "fade" as soon as a rock lands. Specimens must be analyzed immediately if scientists are to detect clues as to where and how long they have traveled in the solar system.

Scientists rushed to Wethersfield. Among the most interested visitors were Dr. Richard McCrosky and Charles Tougas of the Smithsonian Astrophysical Observatory, located 90 miles away at Cambridge, Mass. (The observatory operates a big meteorite recovery network, including 16 unmanned camera stations, in the Midwest. In January, 1970, the network was responsible for the speedy recovery of a 22-pound meteorite that hit near Lost City, Okla.)

The two men quickly confirmed that the rock was indeed a meteorite and arranged for its purchase. It was worth \$1000 to the Smithsonian because it was so fresh. Meteorites have little intrinsic value and do not, as popular belief would have it, contain gem diamonds or precious metals.

For the most part, meteorites are

composed of either iron or stone, with both types containing high percentages of nickel. The Wethersfield rock was of the stony variety and had a gray, concretelike interior flecked with metal dots.

Using radioisotope and gas spectrometer analyses, Smithsonian researchers deduced that the rock once had been part of a far larger body, possibly a planet that was formed with the rest of the solar system about 4.5 billion years ago.

Because the stone contained few gases, the scientists surmised that the parent body must have passed quite close to the sun about a billion years ago—a flyby during which most of its gases were burned away.

About 6 million years ago—a recent date by cosmic timetables—the parent planet apparently disintegrated, either exploding or colliding with another body. It shattered into thousands of small meteoroids that became part of the great asteroid belt between Mars and Jupiter. All this was revealed by the amounts of radioactivity present.

After Smithsonian and NASA scientists had analyzed the Wethersfield space rock thoroughly, it was consigned to the Smithsonian Institution in Washington, D. C. ★★★

HOW TO SPOT A METEORITE

Think that rock in your back yard might be from space? Check this list before running off to your local museum:

1. Is the rock hard, not porous, pockmarked or flaking?
2. Is it irregularly shaped but with rounded edges?
3. Is the object heavy for its size?
4. Does the rock have a black or dark-brown crust?
5. Does the interior of the rock contain metallic iron flakes or spots?
6. Is the object very different from other nearby field stones?
7. Does the stone attract a magnet?

If all the answers are yes, your rock is almost surely a meteorite. If only some of the answers are yes, the meteoritical origin is in doubt; only lab analysis will tell for sure. If most of the answers are no, start looking again.



THIS 24.6-POUND BEAUTY was found near Lost City, Okla., by Smithsonian Observatory scientist. Path of fireball had been recorded by unmanned cameras



New powered craft from German sailplane builder

Built by the German firm of Alexander Schleicher, developer of sailplanes and powered sailplanes, the new ASK 16 is powered by a 68-hp engine that pulls the craft at a maximum 112 mph. Empty weight is 1010 pounds; wing loading, 7.55 pounds per square foot.



Ship preserver

A new method of preserving inactive ships has been put into use at the Philadelphia Naval Shipyard. An air-inflated plastic-treated cover was fitted over the upper portions of the attack cargo ship USS Betelgeuse. With the cover in place, dehumidified air can be circulated throughout the ship and the covered area to preserve the ship's equipment. The procedure reduces the normal amount of work needed to preserve all the equipment installed above the main deck.

Gulps up the litter

Rotating steel fingers at the end of an aluminum boom scoop up bottles, cans, paper and other trash from the roadside as the "litter gulper" moves along a highway. The new device, designed as a fast and cheap way to clear litter from the nation's highways, was recently demonstrated in Washington, D.C. Spectators here are Sen. Jennings Randolph (foreground) of West Virginia and Sen. Lowell Weicker of Connecticut.



How we'll keep 'em moving

Though the harried commuter might not think so, improved methods of transportation are on the way. If you want to see for yourself, visit Washington's big show this spring.

IF IT FLIES, FLOATS OR ROLLS—and is the latest of its type—it's sure to be at Transpo 72, a huge exposition to be staged this spring. It will be a rail and rapid transit show; an automobile, truck and bus show; a ship and boat show, and an air and space show.

Transpo 72 will be held from May 27 to June 4 at Dulles International Airport, outside of Washington, D.C. One aim of the government-sponsored extravaganza is to show what can be done to untangle the traffic mess that plagues urban areas the world over. Four personal rapid transit systems—"people movers"—will be demonstrated. These systems all employ small, independently

TRANSPORTATION
TECHNOLOGY
TRANSPORT SYSTEM

INDOOR
EXHIBITS

INDOOR
EXHIBITS

FORD MOTOR
TRANSPORT
SYSTEM

INDOOR
EXHIBITS

DASHAVEYOR
TRANSPORT
SYSTEM

INDOOR
EXHIBITS

HISTORICAL
EXHIBITS

RESTAURANT

ROHR
MONORAIL

BIG EXPOSITION will require 360 acres for exhibits, demonstration areas and parking for 50,000 cars

powered vehicles that travel at relatively slow speeds on guideways and under automatic control. Flashier vehicles will include autos that drive themselves, guided by electronic devices incorporated in the highway; advanced experimental trains powered by linear induction motors and promising a capability of 300 mph; operational air-cushion vehicles and prototypes of deep-water hydrofoils.

If you're especially interested in airplanes, you'll be confronted with an imposing array, including the new McDonnell Douglas DC-10; Lockheed's C-5A, the world's largest plane; the British Harrier, now adopted by the U.S. Marine Corps, which can fly at 600 mph and also take off and land vertically. If plans work out, the SSTs will also be on hand—the British-French Concorde and the Russian Tupelov 144. There'll be antique planes, too, including the Ford Tri-Motor, Jennie, Curtiss Pusher and more.

Plenty of action is promised. Professional race pilots will zip small planes—none heavier than 550 pounds—around a course. There will be balloon races, simulated dogfights with World War I planes, and demonstrations by the Navy Blue Angels, Air Force Thunderbirds and other aerobatic teams.

According to Transpo 72 officials, the show will be open to the public from 9:00 a.m. to 6:00 p.m. on May 27, 28 and 29; from 12:00 p.m. to 6:00 p.m. on May 30, 31 and June 1, 2; from 9:00 a.m. to 6:00 p.m. on June 3, 4. Admission will be \$3 for adults and \$1 for children. ★ ★ ★



FORD MOTOR'S ENTRY in the "people mover" competition is electrically driven, 24-passenger vehicle

LINEAR INDUCTION MOTOR drives the Transportation Technology Co.'s car. Capacity is 6-10 persons



MONORAIL for carrying passengers at 17 mph is built by the Rohr Corp. System will have two cars

THIRTY-ONE PASSENGERS will ride at 20 mph in the Dashaveyor Co.'s car. Like others, it's automated



Treat your trailer right

Trailer life and fun both can be doubled with the use of simple preventive maintenance

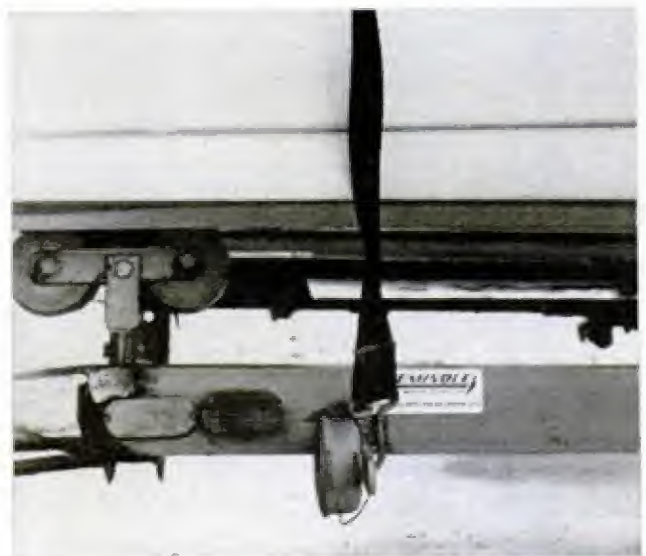
By ROBERT D. STEARNS



TRAVELS WITH YOUR BOAT in tow can more than double your fun, and minor maintenance tips shown here and on the next two pages can add up to minimum problems with the rig.

After hauling out ashore, tilt your outboard back down into its running position. This puts less strain on the transom and prevents formation of the hairline cracks that eventually let in moisture to cause rot in the wood stiffening members imbedded in the stern. Recheck during every trip to be certain your tie-downs are not allowing movement and chafe. Check your own rig to find ways to secure boat to trailer and trailer to car to prevent theft.

90

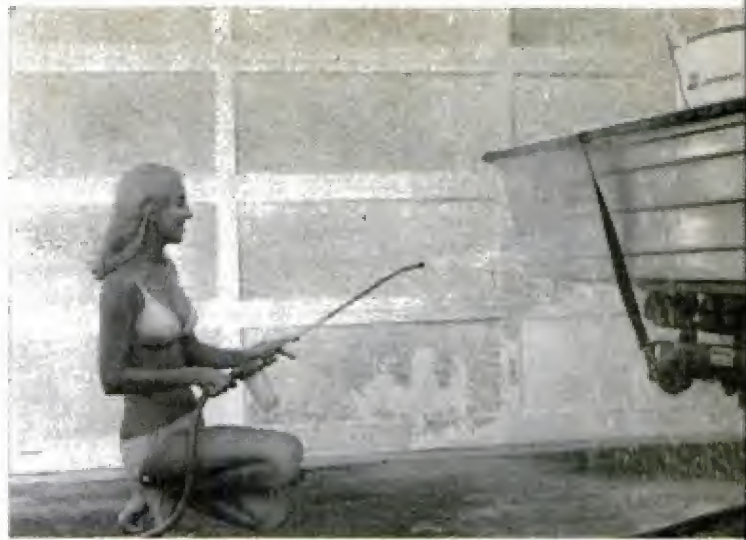


TWIST YOUR TIE-DOWNS before you secure them. This can prevent the whipping caused by the car's slipstream—which can eventually break the strap

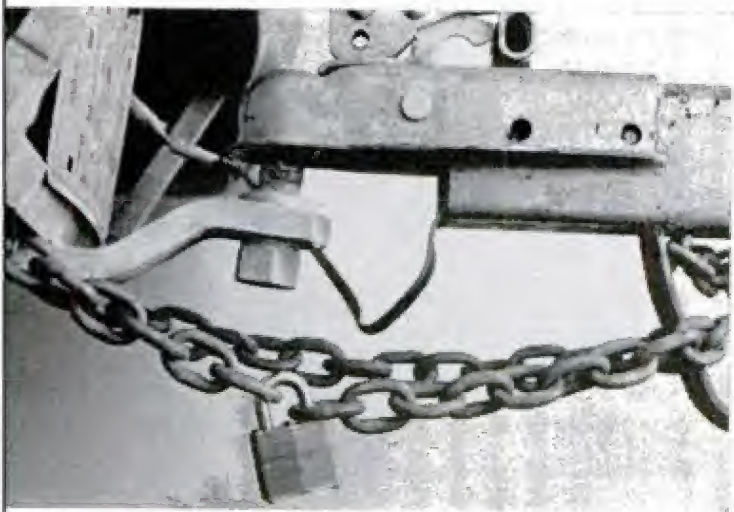
POPULAR MECHANICS



CENTERING BOAT FOR HAULING is easier if you rig bow and stern lines for your passenger to hold against any crosswind while you crank the boat in



HOSING DOWN ADDS UP to longer life for a trailer, particularly around saltwater, when you add a car-wash attachment with detergent dispenser to gear



HEAVY CHAINS AND LOCKS meet the safety laws of most states just as well as the light ones, but a free-swinging lock is more difficult for a thief to cut



HUB CAPS TRAP WATER that causes rust. They can be left off for easy lug-bolt check, then replaced for a "like new" appearance when the trailer is sold



Xs MARK THE SPOT: Reflective tape makes your rig visible when it's towed or parked at night or in fog. Tape's particularly helpful on unloaded trailer



SPARE TIRE AND TRAILER JACK can be bolted to the trailer with a length of ½-inch rod stock and then secured with a lock and chain in a cloth sleeve



HEAVY GREASE PAINTED over the weld seams and into dips in the frame will prevent rust better than paint and it needs reapplication only once a year



LOWER UNIT OUTBOARD OIL can be applied in an emergency to an overheating dry trailer bearing. Keep your speed down until bearing can be repacked



DEFORM OR BURR the threads of the bolt securing winch handle in place to prevent loss or theft. Chisel and hammer other bolts to stop loosening



PAINTING HALF-AND-HALF MIX of a heavy motor oil and mineral spirits or kerosene onto the spring leaves can keep them more limber and rust-free



BOW STOP CHAIN or cable will prevent boat from climbing the car during emergency stop. Do not use a soft metal hook to snap to the trailer or bow eye

SALTWATER particularly can corrode the exposed metal of your trailer, yet periodic touch-ups are an easy way to control rust before it gets started. Springs and bearings also need extra attention. Moving parts heat up during high-speed runs, especially with the extra revolutions small wheels must make; bearings may suck in moisture when submerged in cold water. ★★★

POPULAR MECHANICS

Giving it the new oil

Handing your outboard, chain saw, lawnmower or snowmobile the old oil can wreck it. Today's two-cycle fuel is friend or enemy—depending on new gas/oil ratios and blends

By MARC MICHAELSON

KEY WORDS on your can of oil are "two-cycle" for outboards, snowmobiles, lawnmowers, saws that need fuel mix

THE MODERN well-made and engineered two-cycle engine—outboard motor, snowmobile, chain saw or lawn mower—could run almost forever, manufacturers claim, but thousands of the little mills are discarded every year because their owners try to feed them fuel they can't digest.

In the two-cycle engine, oil is mixed with the gasoline and burned in the cylinder. Automotive-type oils are not satisfactory. They are blended for the special problems of the four-cycle engine, and almost half of that quart can of car oil may be additives that are great for your car but can mean death for the combustion chamber of your two-cycle engine. Today's lead-free gasoline is also considered dangerous for two-cycle use at present, although most manufacturers hope to have motors that will tolerate it by 1973 or soon after. To replace the anti-knock properties of lead, substitute gasoline additives are being used that might attack some of the metals in

APRIL 1972

Photo by Robert D. Borst

lightweight two-cycle mills.

Present advice from outboard motor makers is: Don't use nonleaded gasoline in your two-cycle engine this year. Do mix in an oil especially recommended for your two-cycle rig, and follow directions for gas/oil ratio and proper blending.

Gassing up your two-cycle tank and then pouring in a little auto-grade oil is a first step to serious trouble. Older engines that use richer oil-to-gas ratios and do not have capacitance-discharge ignition are particularly susceptible to preignition. It can pound your motor to pieces. Carbon and metallic deposits that form on the top of pistons or near the sparkplugs glow hot and fire the fuel in the cylinder before the sparkplug goes off. This early firing catches the piston only part way up on

(Please turn to page 194)

New boats and gear



BOATS NEVER USED TO CHANGE much from year to year, but lately there has been a new look: the open utility fishing hull that has been surging ahead in popularity. Small shoal-draft models, like the bass boat descendant of the pirogue and log canoe, can handle thin-water bonefishing and gunkholing. Larger models, like AMF Slickcraft's Robalo above, can handle off-shore waters. Characteristics of the type include a mid-cockpit control console, a forward fishing platform and often a self-bailing cockpit. The Custom 19 shown includes these features plus a design by Ray Hunt, father of deep-V hull forms, an optional shade canopy, and a swordfisherman's pulpit equipped with a stainless bow rail and a vinyl rubrail.

FOR TROLLING AND FOR SAFETY, a new I/O Auxiliary Motor Bracket from N. A. Taylor Co., Gloversville, N.Y., allows the use of an outboard motor of up to 10 hp right on an OMC, Volvo or MerCruiser stern drive. The I/O still steers and tilts up normally with the bracket attached, and it bolts to the outdrive without the need for transom holes. The vinyl-finished units are sold for less than \$30.





POLISHING CURVED SURFACES is reported to be easier with a Grind-O-Flex wheel made up of abrasive flaps. The multiple flexible strips, available in various grits, are claimed to shine, sharpen or grind. A six-inch wheel is \$7.65 from Merit Abrasives, Compton, Calif.



TAKING A LONG LOOK is easier with Tele-Specs from Chris-Craft's Marine Accessories Div., Algonac, Mich. The \$12.95 sunglasses have telescope lenses in the earpieces that can also be used individually as chart magnifiers.

SOUP IN THE LAP is less likely while you're afloat, or at least the bowl will stay put on the table with the hull heeling as much as 30°, according to the Yachting Tableware Co., Box 546, Wilmington, Del. A nonskid 42-piece set of dishes having your boat name and flags inscribed on each piece is offered for \$85.

APRIL 1972



PERMANENT SAFETY is a feature of new transom ladders manufactured by Marailco Div., Allied Products, St. Petersburg, Fla. In addition to a man overboard, skiers, swimmers and divers should prefer this permanently mounted convenience. The two-step model is \$29.



PURPLE CLEATS and ruby red chocks are now joining conventional chrome running lights that are equipped with corrosion-resistant chrome metal tops and Lexan bases. A variety of new Chromalex fittings is available from Perkins Marine Lamp & Hardware, Miami, Fla.



Who says you can't put extra lenses on a fixed-lens camera!



By BURT MURPHY



PUT A TELEPHOTO LENS on a snapshot camera? You might say impossible. For years, many owners of inexpensive cameras have longed to take telephoto shots, wide-angles or close-ups, but have assumed it couldn't be done. The fact is, it can. Telephoto, wide-angle and close-up accessories are available for many fixed-lens cameras from simple snapshotters to such sophisticated types as rangefinder 35s and twin-lens reflexes that are normal-

ly limited to one built-in lens system.

While these accessories can't be expected to equal the performance of much costlier and more powerful interchangeable lenses, they do greatly extend your shooting possibilities. They're relatively inexpensive, easy to use and can add excitement and interest to your picture-taking.

Some makers provide attachments to fit their own cameras; in other cases, such aids can be purchased from

WIDE VARIETY OF SLIP-ON LENSES for fixed-lens cameras is shown below. They include telephoto, wide-angle and close-up attachments to fit Instamatic, Polaroid and other models

companies specializing in accessory equipment. Polaroid, for instance, offers close-up and portrait lenses for its own models, but additional telephoto and wide-angle accessories are also available from other suppliers. The first thing to do is to check on your particular camera by studying the manual that comes with it or by consulting a photo dealer. If the manufacturer does not offer auxiliary lenses, chances are good that you will still be





THREE DIFFERENT VIEWS of same scene illustrate effects you get with an Instamatic 300 camera using Kalimar's telephoto and wide-angle attachments shown at top of opposite page. Upper photo at left is with camera's normal lens unaided. One above is with telephoto lens added, showing marked increase in image size. Lower photo at left is with wide angle attachment. Note that image is slightly smaller than view with normal lens, but covers a broader area. A supplementary viewfinder, also shown at top of facing page, is designed to clip on most Instamatic models to indicate area taken in by accessory lenses

shooting subjects far away or for getting good frame-filling portrait shots. The wide-angle attachment increases picture area by about 75 percent, giving you a broader angle of view without any magnification.

Because telephoto and wide-angle attachments change a camera's normal field of view, an auxiliary viewfinder is also needed to show you what picture area the new lens combination is taking in. The accessory finder either fits over the existing viewfinder or clips on top of the camera and is used separately. The difference depends on the type of camera you have. Kalimar makes a one-piece combination lens and viewfinder for cameras whose built-in finders are located directly above the lens. You slip on the auxiliary lens and the attached finder automatically covers the viewfinder window in the camera. For cameras where the finder window is offset from the lens, a separate clip-on finder is required.

While accessory lenses are available

able to obtain them from other sources.

Kalimar, one large supplier of accessory lenses, is a good source of telephoto and wide-angle attachments for Kodak's Instamatic line and many Polaroid models. They also offer similar auxiliary lenses for rangefinder-type cameras and twin-lens reflexes such as the Rolleiflex.

Accessory lenses are designed to slip over the front of the camera's regular lens and work in combination with it. Kalimar's telephoto attachment has the effect of doubling the focal length of the original lens, giving you approximately twice the image size you'd normally get. This is handy for



ROLLEIFLEX OWNERS can take close-ups with this set of Honeywell Rolleinar accessory lenses, one for upper viewing lens and one for the lower taking lens. Resulting focusing range is 9½ to 12½ inches



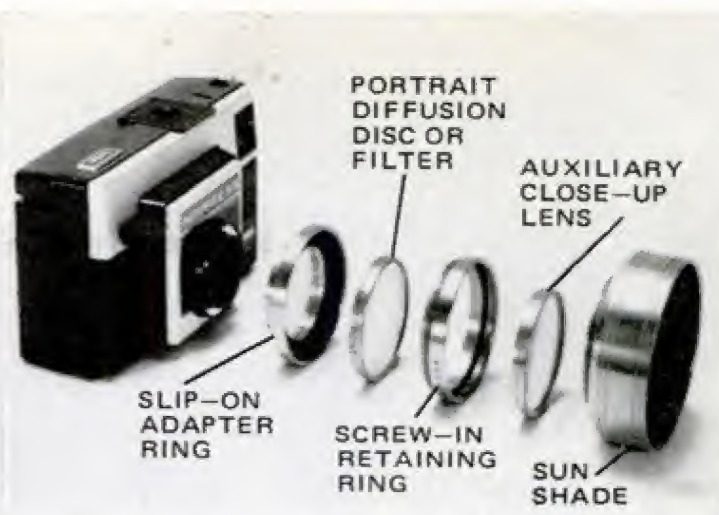
individually, most are sold in sets or kits, including the necessary matched viewfinder. Some kits contain both a telephoto and wide-angle attachment along with a combination viewfinder in a convenient carrying case. Kits offered by Kalimar for Instamatics range in price from about \$27 to \$36, depending on model. Those for Polaroids run from about \$20 for the Swinger to about \$50 for auto color pack models.

For owners of Kodak's new X-series Instamatics, Kalimar has just announced a special set of attachments including telephoto and wide-angle lenses, accompanying viewfinder and carrying case for \$26.95. For twin-lens reflex owners, Kalimar offers auxiliary lenses in pairs for a telephoto or wide-angle effect. One auxiliary covers the lower taking lens, the other the upper viewing lens. Prices range from about \$20 to \$25, depending on camera make and model. Accessories are limited, however, to f/3.5 twin-lens models.

Close-up lenses for the Rolleiflex, available from Honeywell, fit both f/3.5 and f/2.8 models. Called Rolleinars, they narrow the focusing range

ADD-ON TELEPHOTO at left is designed to slip on a camera's existing lens instead of replacing it. Used with normal 50-mm lens, it gives equivalent of 350-mm telephoto. Photos below show same scene shot without attachment (left) and with it (right). Note tiny image of sign in center of left-hand picture compared to greatly enlarged view at right. Price of the Spiratone Teletach accessory is \$19.95





to 9½ to 12½ inches for close-in, big-image shooting. Prices are \$30 to \$40.

Polaroid's own close-up and portrait kits contain three pieces—the supplementary lens itself, a matching viewfinder attachment and a diffusion disc that slips over the flash head. The diffusion disc permits close flash shots without overexposing the subject. The portrait kit provides a focusing range from 19 to 42 inches, and the close-up kit allows even tighter shooting from 9 to 15 inches. Prices are \$9.95 to \$10.95, depending on model.

Close-up lenses are also available in standard Series V, VI and VII sizes. They vary in power from Plus-1 to Plus-10, with Plus-1, 2 and 3 being the three most common. The higher the

(Please turn to page 205)

SLIP-ON ADAPTER RINGS make it easy to mount auxiliary close-up lenses, filters and other accessories on just about any camera. The Kodak rings come in various diameters to fit many different lens sizes. By using additional retaining rings, two or more lenses and/or filters can be combined



VIEWFINDER COMES ATTACHED on this one-piece Kalimar telephoto—handy where camera's viewfinder window is centered over lens. Where window is offset, a separate auxiliary viewfinder is necessary



FOR POLAROID CAMERAS, there are accessory portrait and close-up kits made by Polaroid itself. These consist of a supplementary slip-on lens and auxiliary viewfinder that fits over the regular

APRIL 1972



viewfinder (left, above). Kalimar also makes telephoto and wide-angle attachments to fit Polaroids. At right is Kalimar's handy copying stand for making quick Polaroid copies of pictures and drawings

AUTOMOBILES



Two fwd giants: Both excel

By MICHAEL LAMM, West Coast Editor



AH ELDORADO! Among other absolutes, it's the biggest front-wheel-drive (fwd) automobile in the world. And it offers the only U.S. convertible in its price class. Too, it's the only fwd convertible made in America.

A mere 17.3 percent of Eldorado owners bought their cars *because* it had fwd (less than half the Toronado's percentage). Surprisingly, 26.6 percent opted for the Eldo because it comes in a convertible body style—an amazingly high figure when you consider that, industrywide, less than one percent of all cars now sold are convertibles!

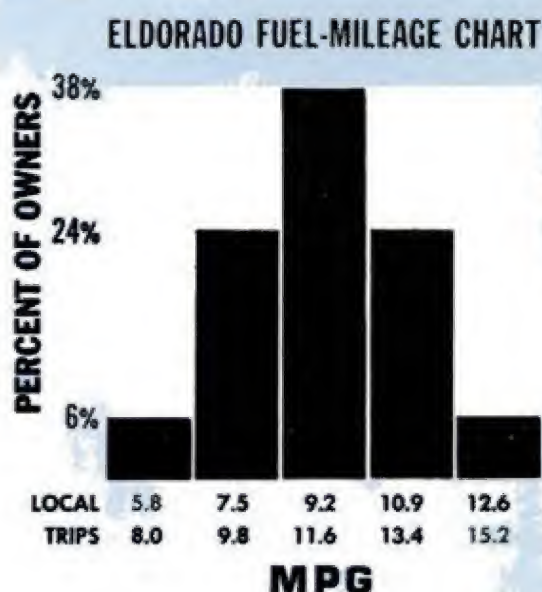
(Keep in mind, though, that neither Lincoln nor Imperial nor any other Cadillac series offers a convertible, so if someone lusts after a domestic luxury soft-top, the Eldorado is it.)

What sort of person buys an Eldorado? "Got the best price out of four dealers," confides a New Jersey hand-

(Please turn to page 102)

PM CADILLAC ELDORADO OWNERS REPORT...

A nationwide survey based on 534,000 owner-driven miles



in prestige and gas guzzling

Photos by the author

WE RAN our last Toronado Owners Report in June 1970, and at that time front-wheel drive (fwd) ranked No. 1 as the reason for buying (41.6 percent). Today, fwd rates No. 2 at 36.8 percent, with styling now heading the list.

Even so, owners feel strongly about fwd. They think it's great, and they're very loyal to it.

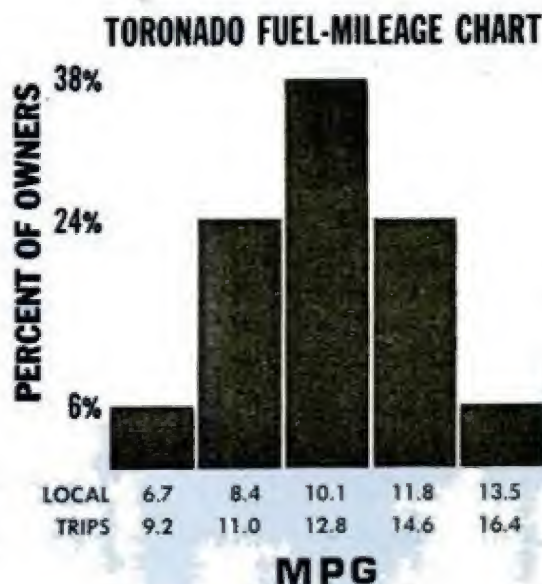
Says a Cincinnati ad exec: "It has a unique feel of 'tracking' at high speeds; is far superior to the Thunderbirds and big Buicks I drove previously, particularly on snowy or wet surfaces."

And a Michigan retiree: "Have owned seven Toronados and never had any mechanical problems with any of them. My basic reason for buying was the front-wheel drive for its handling on ice, snow, rain, and in the mountains. Everyone likes the flat

APRIL 1972

PM OLDSMOBILE TORONADO OWNERS REPORT...

A nationwide survey based on 900,000 owner-driven miles





ELDORADO, Toronado now share B-body with all GM coupes. Before, they and Riviera used special E-body

Cadillac bag manufacturer. A Flushing dentist notes: "All service costs are high at the dealer; can be done for less at a local filling station." Says a White Plains cargo hauler: "\$180 for makeready is ridiculous." And 14.7 percent found gas mileage poor. It is poor: 9.2 mpg average in the city; 11.6 on the highway.

The point is the Eldorado owners watch their bucks. While they often indulge in good-natured grumbling, in

many cases they enjoy the privilege, e.g. the Detroit minister who beams, "The price is very, *very* HIGH!" That's undoubtedly part of the Eldorado's charm.

Some other charms: "Image car," says an Illinois sales rep. A retired Texas Air Force officer: "I like the styling and front-wheel-drive roadability." A California stockbroker: "It is my observation that Cadillac owners have less mechanical troubles than



TORONADO SECONDS taillights under rear window. Drivers two to three cars behind see signals easily



Oldsmobile floor. And the car is ideal for hauling our 31-foot Airstream."

Any problems, we asked this same gentleman, and he answered, "Could use a little more trunk space, and wheel balance is very critical. Also, some garages do not have equipment for Toronado wheels."

Let's have several owners give their total impressions of their cars. First, here's a Michigan small-town pharmacist: "Drove one and it handled very well, and when they changed the style for 1971 it appealed to me. Haven't found any defects yet. Driving appears to be more stable, especially on ice and snow. The '72 is comfortable, both back and front. My only complaints are I would like radial tires, and that the nearest Olds dealer is 50 miles away."

This from a New Jersey electrical contractor: "I had Cadillacs and be-

POWER door locks, window lifts, seat control are in door. Rear riders can no longer reach handles

WIPER CONTROL stands alone at left of dash, has mist button to give one sweep for drizzly driving

those who own other brands." An Indiana physician sums it up for many: "I enjoy the luxury of driving a heavy car."

Is front-wheel drive an important attribute in the minds of Eldo owners? Not especially, and not nearly so important as it is to Toronado owners. Most Eldorado drivers say that fwd influenced their buying not at all. They would have bought the car with rear-wheel drive without giving its locomotion a second thought.

A number of owners did, though, link their cars' good cornering, road-holding, traction, directional stability, and flat floor to fwd. An Illinois housewife: "I like the solidness of front drive, especially in snow and rain." A retired Detroit engineer: "Great steer-

RECTANGULAR PANE aids rear vision slightly, but the Eldo coupe's wide pillars make backing hazardous



came dissatisfied. We have a farm in northern Vermont, and I drive back and forth all winter. The Toronado handles wonderfully in snow. But I dislike the position of the spare tire and feel the car needs a bigger trunk. I like a heavy car—it rides well, handles well, corners and brakes well."

A self-employed Chicagoan: "When I got the car, the front-axle grease retainer leaked, timing was off, and the left front window wouldn't shut. Got everything corrected except the seal,

and now I'm getting the stall tactic. I bought the car for its styling and wanted to try front drive. I judge quality poor and was amazed to find two dents on top of the rear quarter; also many scratches, nicks, and a large spray of adhesive material on the vinyl top. The front seat is much too high and there is wasted space in the mounting frame and thickness of the seat. It surely wasn't designed with comfort in mind."

An Arkansas agricultural chemist:

FWD USED TO RANK NO. 1 with Toronado buyers. Now it's styling. Eldorado owners aren't so hep on fwd





OWNERS COMPLAIN of small trunks in Eldorado and Toronado; ditto legroom in coupes' rear seats

Cadillac ing and handling on ice." No one considered fwd a drawback but for a tiny minority who complained of excessive tire wear and alignment problems.

Just what does an Eldorado owner get that the Toronado owner doesn't? In terms of measurables: 4.3 inches more wheelbase, 3.4 inches more overall length, 70 extra pounds of weight, 15 fewer rated horsepower (which

means nothing—Cadillac always underrates its engines), and two gallons more fuel capacity (27 vs. 25). The Eldo gets slightly worse gas mileage than the Toro, partly because of its lower differential ratio (3.07 vs. 2.73) and partly because it's feeding 45 more cubic inches of V8. For all this, the Eldorado owner pays a couple thousand dollars more in base price.

For prestige, luxury and state of mind, there's no measuring. Many buyers, of course, put the intangibles far ahead of all other attributes.

Cadillac has a very strong record of owner loyalty—stronger even than Toronado's, one of the strongest in the industry. Says a Massachusetts stockbroker: "This is my fifth Eldorado. I like the car very much, but at the same time I'm afraid they can become troublesome after a year, so every year in September I trade for a new one. Each car has no more than 12,000 miles on it." (This guy sounds like a used-



RUBBER BUMPER INSERTS are horizontal on Toronado, vertical on Eldorado; '72 bumpers use heavier metal

Oldsmobile "We had an electrical problem, but the dealer fixed it fine. Our dealer is very good. We bought our Toronado because it was recommended by friends. We consider quality good except the car uses oil and the trunk leaks. It also uses too much gas. I particularly like its stability on the highway and its sleek look."

A Pennsylvania executive: "Now driving my third Toronado—always

receive good dealer service. Bought because of fwd. It will go anywhere in any weather. Workmanship on a par with other cars, which leaves a lot to be desired. Needs wheel design changed because many service stations do not have equipment to remove tire from wheel. I speak from experience. Other drawbacks—I think the trunk is too small, and so is rear legroom, and I can hear all electrical noises (turn signals, wipers, foot brake) through the radio."

A Virginia medical illustrator: "When you're out in the boondocks, country mechanics don't know how to fix this car. I've had a little carburetor trouble, the radiator leaks, and the car uses about 1½ quarts of oil per 1000 miles. My dealer usually gives me the runaround, telling me stuff like they can't get a part because it's not catalogued yet. I've had the car back five times—it's still not right. Parts have been left off and mechanics are

What's ahead for front-wheel drive?

Automakers are turning to the compact Wankel as a cleaner engine for the future, and front-wheel drive is the logical drive train to use with it

AFTER 70 YEARS as an also-ran, front-wheel drive (fwd) seems destined to step out as the automotive propulsion system of the future. Why? Because the Wankel looks like the engine of the future.

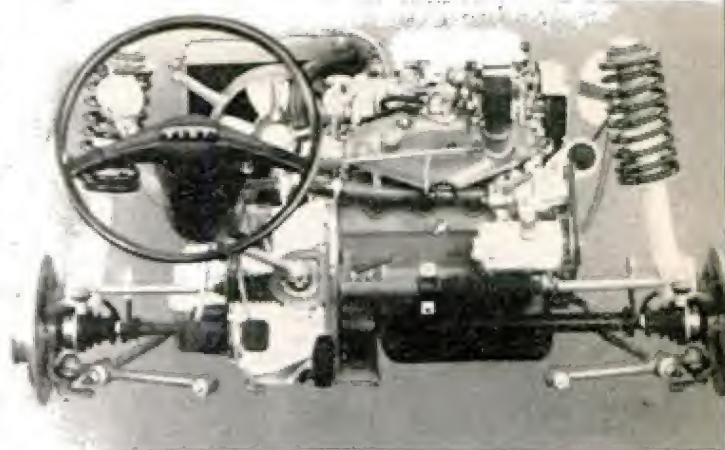
As the Wankel takes over from piston engines, fwd begins to make more and more sense. A lighter, more compact powerplant leaves more space and more leeway for weight up front. Thus it will become more economical and more reasonable to produce a self-contained power unit, and that unit means fwd.

In the past and even today, piston engines together with fwd have made for front-heavy cars. Most have had a natural tendency to understeer; i.e. the car tries to keep going straight even though the front wheels are turned. This tendency will become less pronounced as smaller, lighter engines evolve.

Without a long driveshaft passing through the car (and it does pass through, not under), you get no transmission hump. The interior floor can be entirely flat. There's more trunk room because there's no differential case to allow clearance for. And the whole car can be built lower to the ground, giving better stability and less wind resistance.

Fwd has always given better directional stability in crosswinds. It's let a car pull out of ruts by simply turning the front wheels and applying power. Fwd gives good traction on slippery surfaces.

Problems with fwd have been mostly technological—adapting automatic transmissions, power steering, and in developing reliable, inexpensive axle joints. You have to remember that to drive the front wheels, the axles need to be jointed at both ends. These joints must withstand torque and braking loads, plus allowing for suspension travel and steering. Today, though, we have good axle joints, and most previous technological problems have been solved.



FIAT'S NEW 128 SERIES has sohc four set crosswise ahead of axles, with transaxle alongside block, as in the BLMC minis. The point is that the entire unit is self-contained, compact, light and easy to service

Yet it's presently more expensive to manufacture a car with fwd than one having identical specs but with a rear drive. This is because the long propeller shaft and separate rear-axle unit still cost less to mass-produce than axle joints, transaxle, and suspension members needed for fwd.

Since the Wankel will permit smaller, lighter power units, once mass production of rotary engines starts, the smaller, lighter bodies allowed by fwd will offset the added expense of fwd hardware. Savings will come via fewer parts, less metal, and lower labor costs. Moreover, fwd will make it cheaper to incorporate another needed innovation—independent rear suspensions.

General Motors is working full-bore on perfecting the Wankel for wide use and mass production. And it's planning to mate the Wankel to fwd exclusively. Time schedule for the big switch is still cloudy, but Oldsmobile has a 1973-74 small car in the offing. Rumor has it that this Vega-sized model might use GM's first Wankel. Though Olds denies it, there's a good chance it'll also use front-wheel drive.

In addition to the Olds Toronado and the Cadillac Eldorado, the cars with front-wheel drive that you can buy in the United States now include Audi, Austin, Citroen, Fiat, Honda, Lancia, Peugeot, Renault, Saab and Subaru. The number of cars that are switching to fwd grows every year. The day you put snow tires on the front of your Chevrolet may be sooner than you think!—M.L.



Cadillac car buyer's delight and perhaps accounts for some of Cadillac's high resale value. Still, though Cads keep a high percentage of resale value, the actual dollar depreciation is greater than that for less expensive cars.)

Rumors around Detroit have hinted that Cadillac is considering a more compact model—something the size of

ELDO CONVERTIBLE eclipses sunroof's popularity, remains the only soft-top in domestic luxury field

a Mercedes sedan. So we asked owners, "If Detroit made a smaller, less expensive fwd car, would you be interested in buying one?" Some 63 percent said no, giving the following reasons: "I am not hung up on fwd." "I don't like small cars." "It wouldn't have my Caddy's ride." "I need a good, heavy highway car." "Once you drive an expensive car, you'd never be happy with a cheap one."

What changes would Eldorado owners like to see? "Legroom in back should be bigger." "Faster pickup." "A four-door Eldorado would be nice." "Improve the styling of the rear end. I think the front design is wonderful, but the back end stinks. Must have had two different designers. Looks like a buffalo: large in front, small behind." "More trunk room." "Don't change a thing—I like the big, bold look." ★★★



TORONADO front discs use wear indicators: metal tangs that set up a squeal when the pads wear out

Oldsmobile sloppy all around. Factory workmanship is no better. Both doors rattle, the left window doesn't close all the way, and several electrical switches were bad. I took the doors apart myself and found that no attempt had been made to insulate the rattly places, so I rubberized them."

More typically, though, Toronado owners are happy with their purchases. "All in all, it's superb," says a Minnesota lawyer, who also rates workmanship excellent; ride, steering, handling and brakes likewise. Most owners, when they do find fault, mention relatively minor items, like the North Dakota real estate man who wrote a long diatribe about the fact that he couldn't match whitewall designs between his factory tires and a new set of snow treads. He couldn't forgive Oldsmobile that oversight! ★★★



GLOVEBOX takes long reach. Coins and small items left atop dashboard fall into slots at windshield

Summary of 1972 Cadillac Eldorado Owners Reports*

Total miles driven534,299

Average miles per gallon

Local driving 9.2
Long trips11.6

Body styles:

Coupe73.4%
Convertible26.6

Why the Eldorado?

Style42.0%
Past experience28.0
Front-wheel drive17.3
Prestige10.0
Quality 8.7

Specific likes:

Styling64.9%
Handling39.2
Comfort28.4
Ride26.4
Performance20.3
Prestige10.1
Power 9.5
Roadability 9.5

Specific dislikes:

Workmanship19.6%
Poor gas mileage14.7
Small trunk11.9
Rattles10.5
Poor ride 5.6

What changes would you like?

Better workmanship 8.9%

More rear legroom 8.1
Larger trunk 6.5
Different styling 5.7
Better gas mileage 4.8

How long have you been driving
two cars?

Less than 1 year40.9%
1-2 years13.0
3-5 years39.6
6-10 years 3.9
10-25 years 1.9
More than 25 years 0.6

Would you buy a smaller U.S.
two car?

No63.3%
Yes36.7

Why would you?

Better handling28.7%
Eldorado too large 6.9
Better economy 4.0

Why wouldn't you?

Like big, heavy cars56.4%

Would you ever buy a front-
engine, rear-drive car?

Yes83.7%
No16.3

Had any mechanical trouble?

No64.9%
Yes35.1

What kind of trouble?

Electrical 9.6%
Carburetor 9.6
Cold starts 9.6
Front-end alignment 9.6
Windshield wipers 7.7

Did you repair it yourself?

No100.0%

Dealer repairs satisfactory?

Yes78.4%
No21.6

Is the Eldorado your only car?

No 7.7%
Yes21.3

Other cars owned:

Cadillac28.1%
Chevrolet27.3
Pontiac13.2
Ford12.4
Buick10.7
Oldsmobile10.7

Age distribution of owners:

15-29 years 8.7
30-49 years51.3
50-plus40.0

Would you buy another Eldorado?

Yes92.4%
No 7.6

*Percentages might not equal 100% due to rounding and/or insufficient data.

Summary of 1972 Oldsmobile Toronado Owners Reports*

Total miles driven900,761

Average miles per gallon

Local driving10.1
Long trips12.8

Why the Toronado?

Style46.0%
Front-wheel drive36.8
Past experience21.6
Handling10.4
Comfort 4.8

Specific likes:

Handling64.1%
Styling54.7
Comfort24.9
Riding qualities19.6
Front-wheel drive15.9
Roadability15.5
Performance10.6

Specific dislikes:

Poor gas mileage17.3%
Not enough legroom12.4
Poor workmanship11.9
Not enough trunk room 9.5
Rattles 9.5

What changes would you like?

More legroom19.2%
Bigger trunk17.8

Four-door model 9.4
Better gas mileage 4.7
Different styling 4.7

How long have you been driving
two cars?

Less than 1 year51.2%
1-2 years 8.0
3-5 years30.8
6-10 years 9.6
11-25 years 0.4
More than 25 years 0.0

Would you buy a smaller U.S.
two car?

Yes50.2%
No49.8

Why would you?

Better handling36.5%
Better gas mileage10.8
Prefer smaller size 3.0

Why wouldn't you?

Like big, heavy cars49.8%

Would you ever buy a front-
engine, rear-drive car?

Yes73.8%
No26.2

Had any mechanical trouble?

No64.0%
Yes36.0

What kind of trouble?

Electrical15.4%
Carburetor14.3
Alternator 7.7
Oil leak 6.6

Did you repair it yourself?

No94.5%
Yes 5.5

Dealer repairs satisfactory?

Yes68.7%
No31.3

Is the Toronado your only car?

No71.7%
Yes28.3

Other cars owned:

Oldsmobile33.5%
Chevrolet30.2
Ford12.1
Volkswagen 7.7
Pontiac 7.7
Dodge 5.5
Cadillac 5.5

Age distribution of owners:

15-29 years15.8%
30-49 years49.8
50-plus34.4

Would you buy another Toronado?

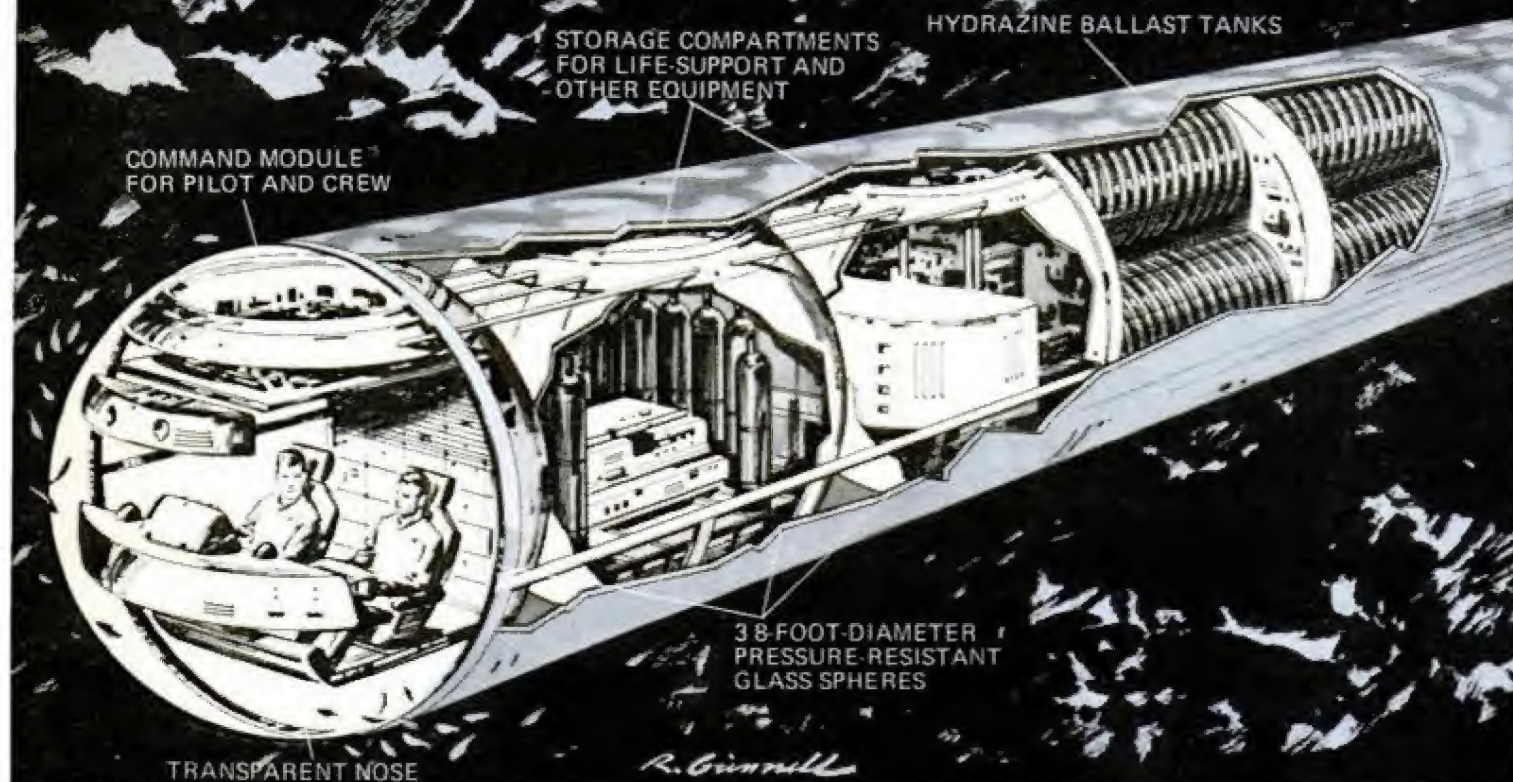
Yes88.5%
No11.5

*Percentages might not equal 100% due to rounding and/or insufficient data.

Motorless sub to 'fly' the

If you can glide through air, you can glide through water. A motorless submarine designed to do just that is currently under study at the Oceanic Institute at Makapuu, Hawaii. It's 72 feet long, has stubby wings and sports an airplane-like tail. It contains no engines except for two small wingtip propellers used only for docking maneuvers. At

the beginning of the "flight," the pilot takes on seawater ballast to make the sub slightly nose-heavy. The craft then glides slowly toward the bottom, reaching depths of up to 20,000 feet. At the bottom, the ballast is blown out and gas released from pressurized hydrazine tanks to make the sub buoyant. It then glides back up to the surface,



Backpack rolls like a wheelbarrow

Why carry a heavy pack on your back when you can roll it on the ground? That's the idea behind this clever convertible pack carrier designed to ease your burden on long camping hikes. On smooth, level terrain, you simply push it along like a wheelbarrow on a small wheel mounted in a

V-shaped extension on the tubular aluminum frame. When the going gets tough on steep grades or through heavy brush, you remove the quick-release wheel and slip carrying straps over your shoulders. The two-way carrier was devised by Lee, Jesse and David Tracy of Ogden, Utah.

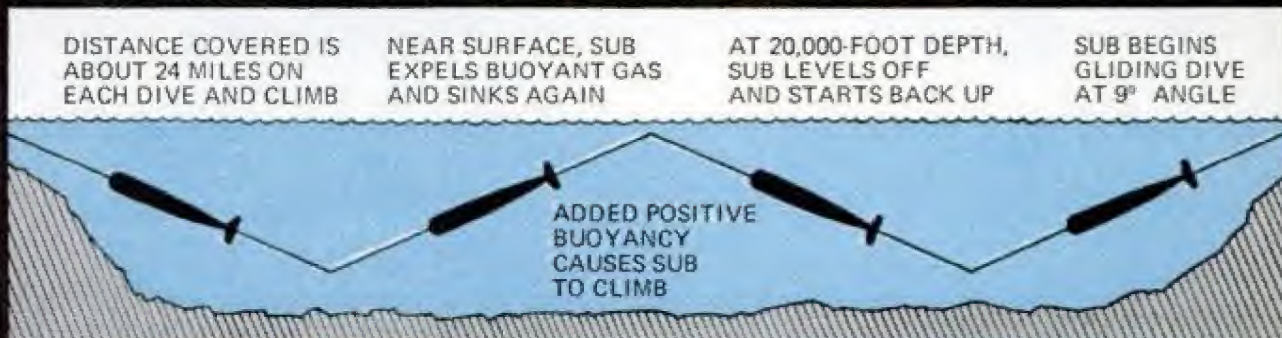


ocean like a glider

JUST PATENTED



and the process is repeated. At this rate, it could travel 24 miles during each dive and climb, covering the distance from Hawaii to the West Coast in 16 days. Because it will be subjected to tremendous pressures at great depths, its main crew and equipment chambers are in the form of three glass spheres with 4-inch-thick walls. Behind these are the hydrazine gas tanks in a fiberglass hull. Air can't be used for buoyancy because, at 20,000 feet, it weighs as much as water and would provide no upward lift. The sub was designed for the Institute by engineer Willis R. Forman who believes the design can eventually make possible low-cost intercontinental transportation.



No-spill spout for a milk carton

Big gallon-size milk cartons are heavy and hard to pour—but not with this handy device. It's a combination carrying handle and pouring spout that quickly attaches to any standard gallon container. It consists of two pointed plastic end pieces that slip into openings at the top of the carton and lock together (left, below). You then screw the spout into a threaded opening, and a

toothed metal ring cuts its own hole in the container as the spout is turned (center). With the spout in place, you just remove the cap and pour (right), with no danger of spilling milk or dropping the carton. When the carton is empty, the handle and spout can be transferred to a new one for reuse. It's sold for \$2.79 postpaid by E. Z. Pour Corp., Box 149, Bayonne, N. J. 07002.



BETTER WAYS TO GET A BETTER HOME

Your best bet for a larger, more comfortable, easier-to-live-in home may be the home you already own. Often, a well-planned home improvement will cost you far less than a move would. With do-it-yourself weather just around the corner, *PM's* editors have rounded up an outstanding collection of ideas that solve most problems. On the next 42 pages you'll see how you can:

Expand <i>down</i> as well as up	Page 111
Update an old living room	Page 112
Remodel a tired-looking bath with an exciting new material	Page 113
Increase living space by extending over the garage. ...	Page 114
Add unusual touches to create an out-of-the-ordinary basement family room.	Page 115
Get more use from your closets by building efficient storage	Page 129
Make patio planters that improve the look of your outdoor "family room".	Page 132
Give an old home an exterior facelift: Five ways to erase the dated look.	Page 134
Install an automatic roof ventilator for greater summer comfort	Page 139
Build a handsome contemporary light for practically nothing	Page 142
Have the convenience of an outside basement entry — easily and inexpensively.	Page 144
Select the latest materials from this great roundup of new products for improving your home	Page 148
Dress up those bare-looking shelf standards.	Page 151





Need more room? Consider that space under the house

THE EXTERIOR and interior views of the home above and at left could not have been photographed eight years ago. That's when Jack Dennis and his wife bought their "small, slightly aged home" because they "just couldn't resist its location." Before they signed the deed, they knew what they wanted—and what they would have to do to get it. To start, they raised the house and built a basement below. Next, the new-found living space was laid out to provide the rooms as shown in the exploded floor plan (page 116). A low-area between

(Please turn to page 116)





Simulated beams and paneling make a world of difference

HAPPILY, home-improvement materials offered today make it easy to create a warm living room such as the one shown above. As can be seen in the "before" photos on page 119, the major faults in the original room are those that you would expect to find in most 50-year-old living rooms: an oversized fireplace with leaded glass windows flanking it, plaster cove where walls and ceiling meet and an open,

(Please turn to page 119)



NEW STAIRWALL and a white Marbletone paneling on outside wall make renovated room appear larger. Freestanding radiator was replaced with recessed type; the new ceiling eliminates pointing and quiets the room



Bath need remodeling? Man-made marble makes it easy to maintain

PROBLEMS designed into the original bath in this 20-year-old home are what triggered its renovation by owner John Gaynor, Seaford, Long Island, N.Y. The lack of adequate storage cabinets for towels, linens and toiletries was annoying. Of even greater concern was a window over the bathtub. It eventually per-

(Please turn to page 123)



ORIGINAL DESIGNS, and plastic material that looks like marble, fill this bath with ideas you can duplicate in full or in part. Photo above shows tub enclosure and factory-made, one-piece vanity top with bowl. At left, towel closet is shop-built as is plastic-laminated medicine cabinet below. Owner altered vanity, left, so clothes hamper is behind doors at far end



An inexpensive way to expand—over an attached garage

WHEN YOU EXPAND over an existing structure, you save a lot of trouble and expense. The basic foundation is already there, and, in some cases, so is the floor. You simply build upward on top, avoiding many of the headaches of starting from scratch. This is what Mr. and Mrs. Larry LeJeune decided to do when their fifth child arrived and they needed more space. The starting point was an attached garage. They conferred with architect Gerald C. Luedke of Minneapolis, Minn., who conceived and designed a two-stage improvement:

- The first was to add a family room, complete with woodburning fireplace, alongside the garage.
- The second was to build over the ga-

(Please turn to page 126)

COLONIAL HOME (left) was adequate when family moved in. When more room was needed, bedroom was added over garage, playroom alongside (above)



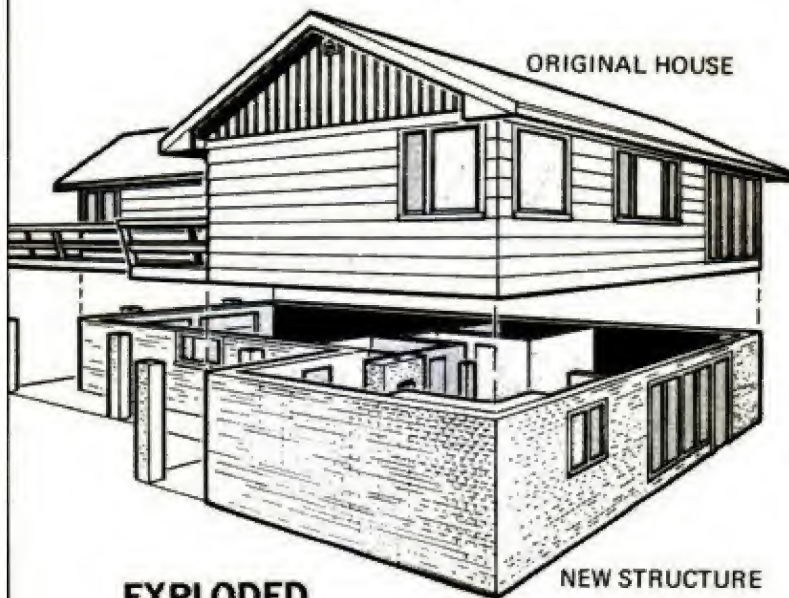
Attention to details 'makes' this family room

START WITH a little imagination, add the ability to do it yourself and you are just about assured of ending up with a home improvement project full of creative—and inexpensive—ideas. David Noyes of Deephaven, Minn., wasn't afraid to tackle the actual work, and for out-of-the-ordinary ideas, he consulted Minneapolis designer Paul Albitz. The resulting warm, informal

(Please turn to page 128)

"OLD WORLD" LOOK is achieved through the use of some dark-stained beams, a wine rack and stemware shelf





**EXPLODED
VIEW**

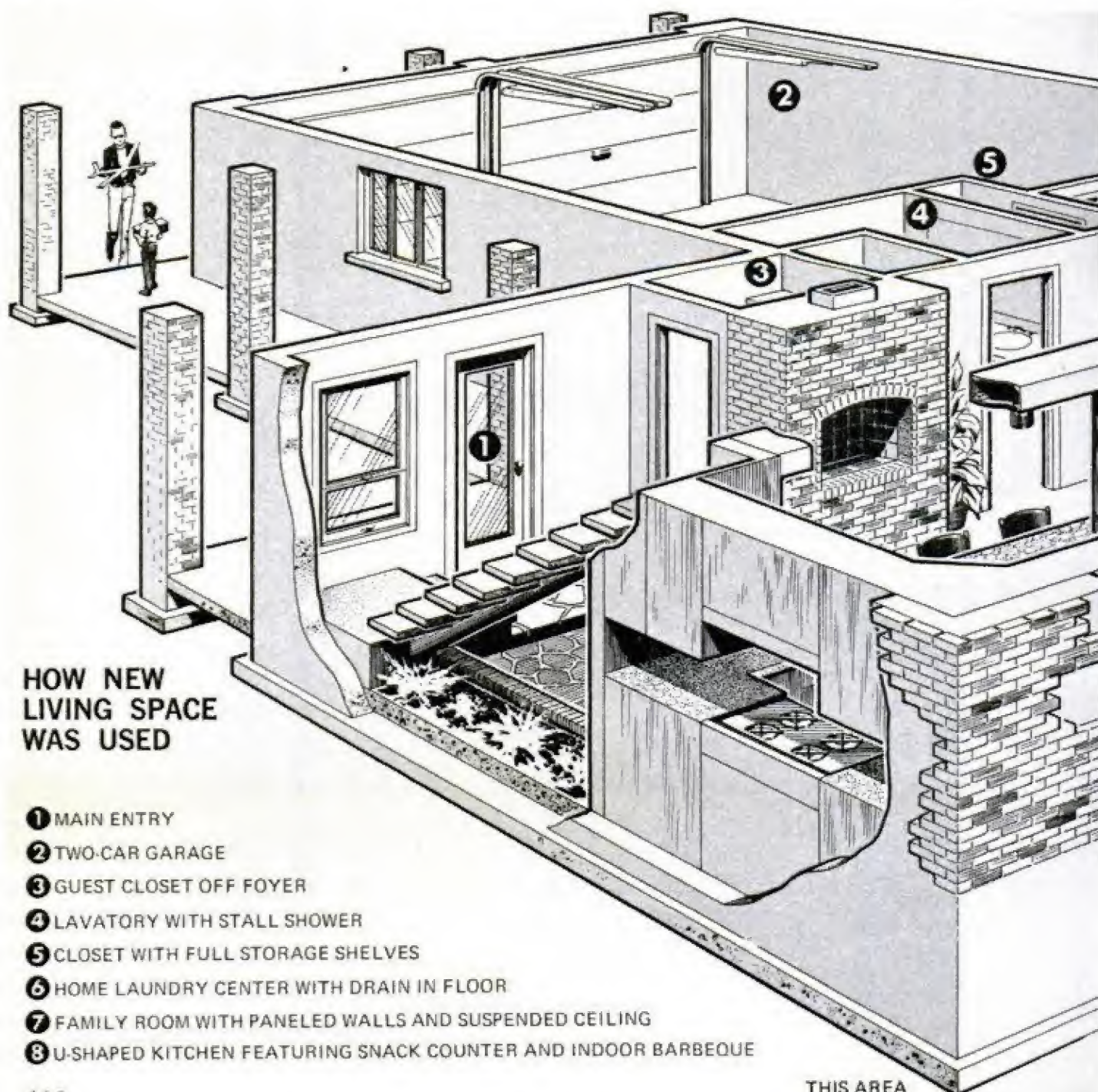
SPACE UNDER THE HOUSE

(Continued from page 111)

street and house was backfilled to provide an on-grade driveway. The original house was then lowered onto the new structure (left).

The existing house was re-sided with rough-sawn cedar and the addition covered with a combination of cream-colored brick (Chaska) and varicolored brick. Hand-split shakes were installed on the roof, and old windows replaced with new.

Stair treads in the unusual, handsome entry (see drawing below) rest on a beam center-support (stringer)



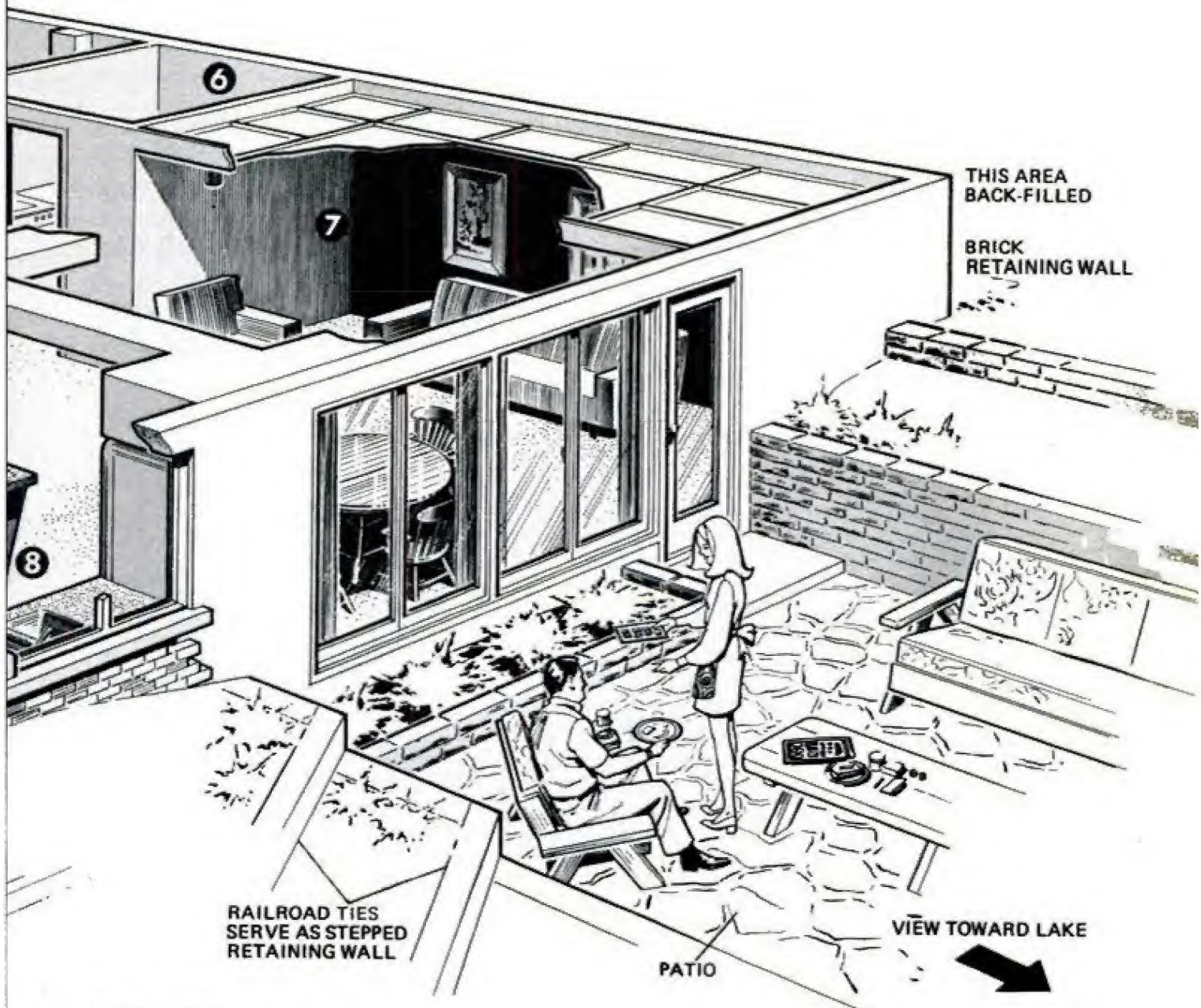
**HOW NEW
LIVING SPACE
WAS USED**

- ① MAIN ENTRY
- ② TWO-CAR GARAGE
- ③ GUEST CLOSET OFF FOYER
- ④ LAVATORY WITH STALL SHOWER
- ⑤ CLOSET WITH FULL STORAGE SHELVES
- ⑥ HOME LAUNDRY CENTER WITH DRAIN IN FLOOR
- ⑦ FAMILY ROOM WITH paneled walls and suspended ceiling
- ⑧ U-SHAPED KITCHEN featuring snack counter and indoor barbeque

**THIS AREA
BACK-FILLED**



VIEW THROUGH KITCHEN shows the cantilevered stairs that lead from the foyer up to the "old" home





STREET SIDE OF HOUSE has pillars added, is now considered rear of house. Family room overlooks lake

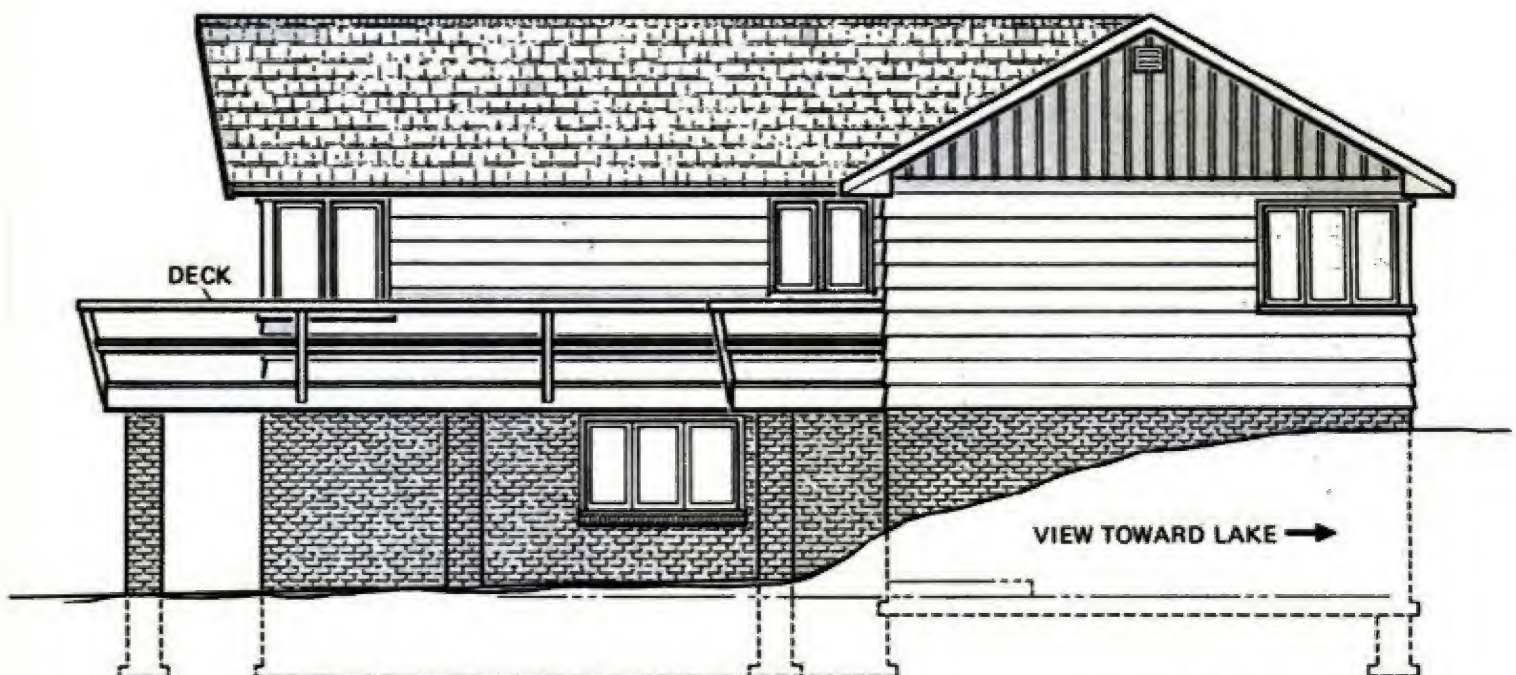
anchored to the outside wall to give a cantilevered appearance. Exposed tread ends are covered with oak facing and each tread is completely wrapped in a bright orange shag rug. Under the stairs is a lighted planting section with a low, curved-brick edging.

The new space provides family activity centers—kitchen, living room,

bath and the like; the existing house was remodeled for sleeping quarters.

The biggest asset is a sweeping view of a lake from the new family room and patio. This feature alone, Dennis said, justified the ambitious undertaking. It also proves that improving a house in an ideal location can be better than moving. ★★★

NORTH ELEVATION



unimaginative stairway leading to the second floor. These were the problems that Harry Wicks, PM's Workshop Editor, faced when he decided to remodel the room shown. How he solved them is shown in the drawings and photos on these pages.

No changes were structural. A quick rundown of the transition reveals, in fact, that the job consisted basically of covering the floor, walls and ceiling, and redesigning the stair and fireplace walls to be more pleasing and functional. And, relying upon his experience in the home-improvement field, Wicks solved the problems using professional techniques that make the job easier and less costly. Thus the materials selected for the project have one thing in common: They are factory-finished to eliminate work steps beyond carpentry (and for years to come).

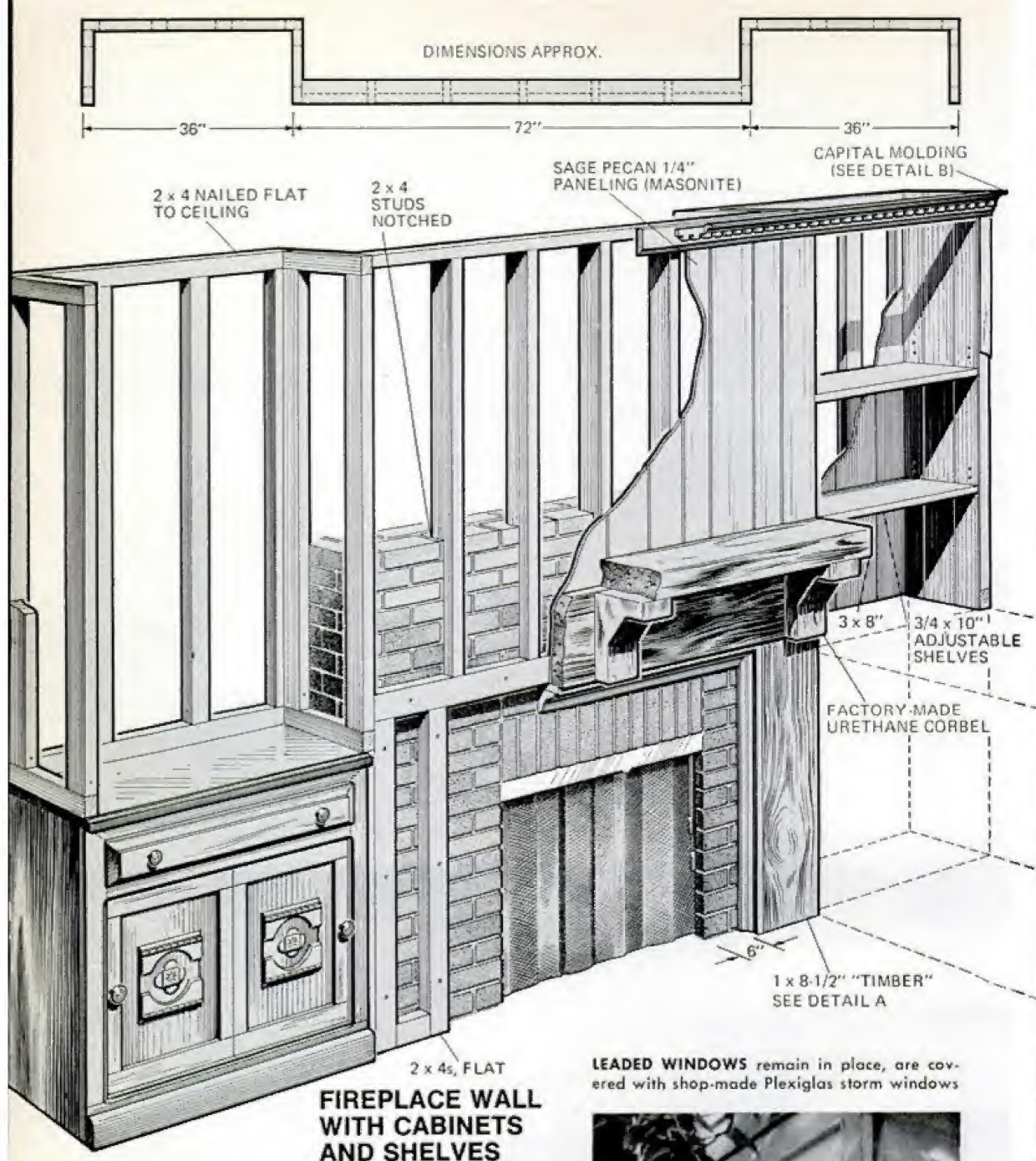
Walls. Since the existing plaster walls were in good shape—sound and with no cracking—they were simply covered with Masonite Pecan Royalcote using panel adhesive and plenty of nails. To make the job easier, vinyl-clad molding was used throughout. Because the room is 8½ ft. high, existing baseboard was also left in place and the sheets of paneling rest on it. The old base was then covered with strips of paneling ripped from waste (door and window cutouts). The existing entry, closet and bi-fold doors were hung to complement the room. The only other wall treatment required was to replace an archaic door chime with a 1972 version.

Ceiling. Two solid reasons made covering the ceiling a better solution than trying to patch what existed. The



"BEFORE" PHOTOS of stair and fireplace walls show dramatic difference remodeling made. Old fireplace was left intact but framed and skinned with paneling. Old, protruding fireplace screen (below) was replaced with recessed screen from Sears, Roebuck. (See page 122 for other manufacturers)





FIREPLACE WALL WITH CABINETS AND SHELVES

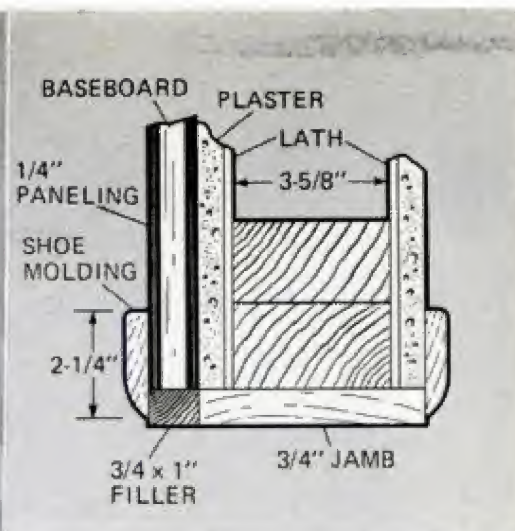
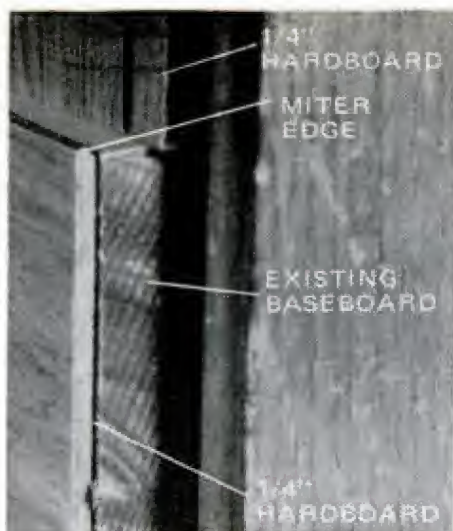
first was the dated, plaster cove and picture molding that surrounded the room. Perhaps more important, was to finally get rid of the calcimine-coated headache that *no* paint seemed to adhere to. The product chosen was a new one, Gold Bond's Brush Tex, and the choice could not have been better. Available in 4x14-ft. sheets, it is heavily textured

120

LEADED WINDOWS remain in place, are covered with shop-made Plexiglas storm windows

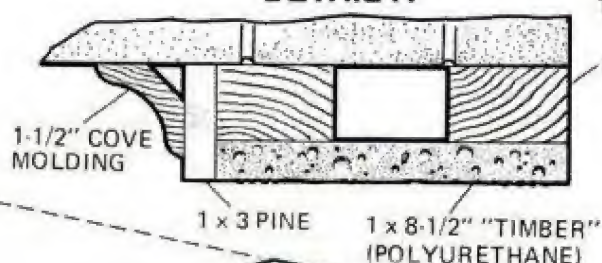


POPULAR MECHANICS

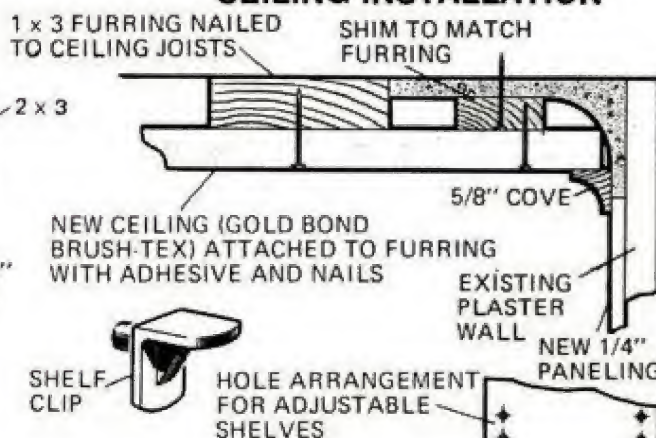


EXISTING BASEBOARD was left for 4x8-ft. panels to rest on. Base was then concealed with strips of the paneling ripped to width on table saw. Drawing shows pine filler-strip added to the existing jamb

DETAIL A

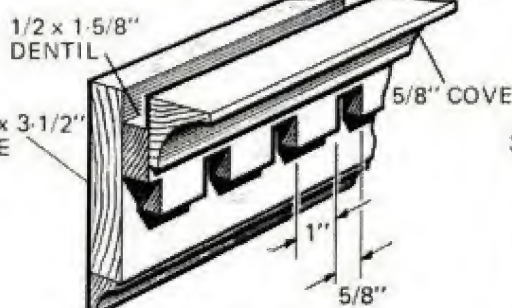


CEILING INSTALLATION

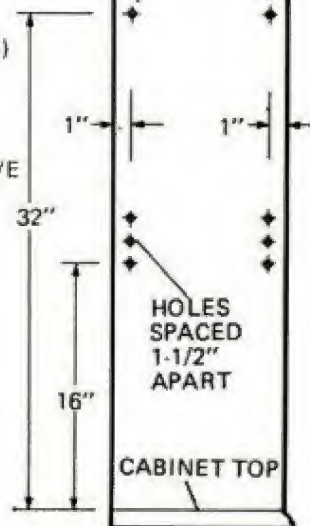


HOLE ARRANGEMENT FOR ADJUSTABLE SHELVES

CAPITAL MOLDING (DETAIL B)



CAPITAL MOLDING (DETAIL B)



SEE TEXT FOR DETAILS

Technical art by Fred L. Wolff

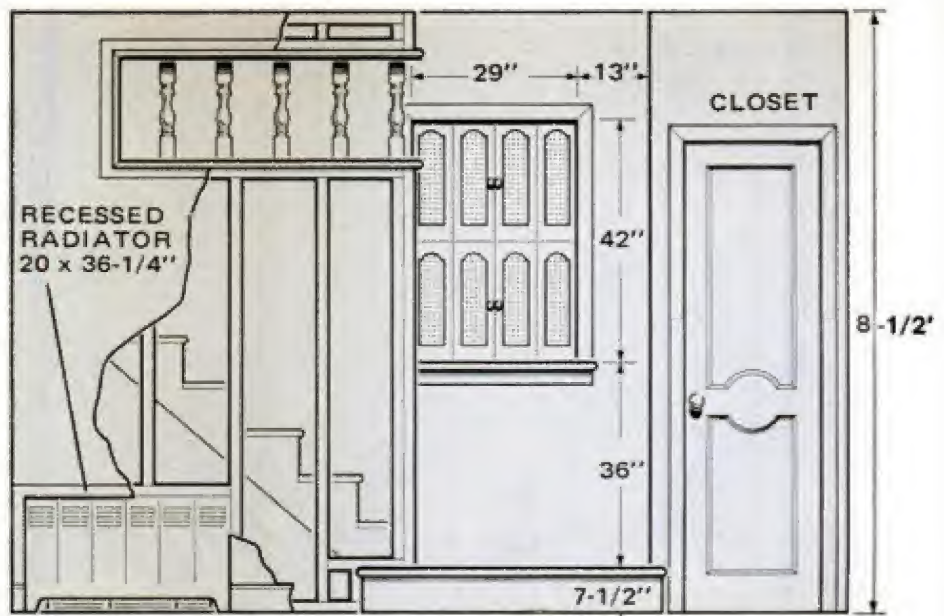
so even if you miss a nailhead and give it a blow with your hammer, it is easily fixed. (A handful of Brush Tex sawdust mixed with Elmer's Glue is simply pushed into the damaged area and, when it dries, you won't even notice the repair.) Urethane beams and a handsome Early American electrical

fixture completed work on the ceiling.

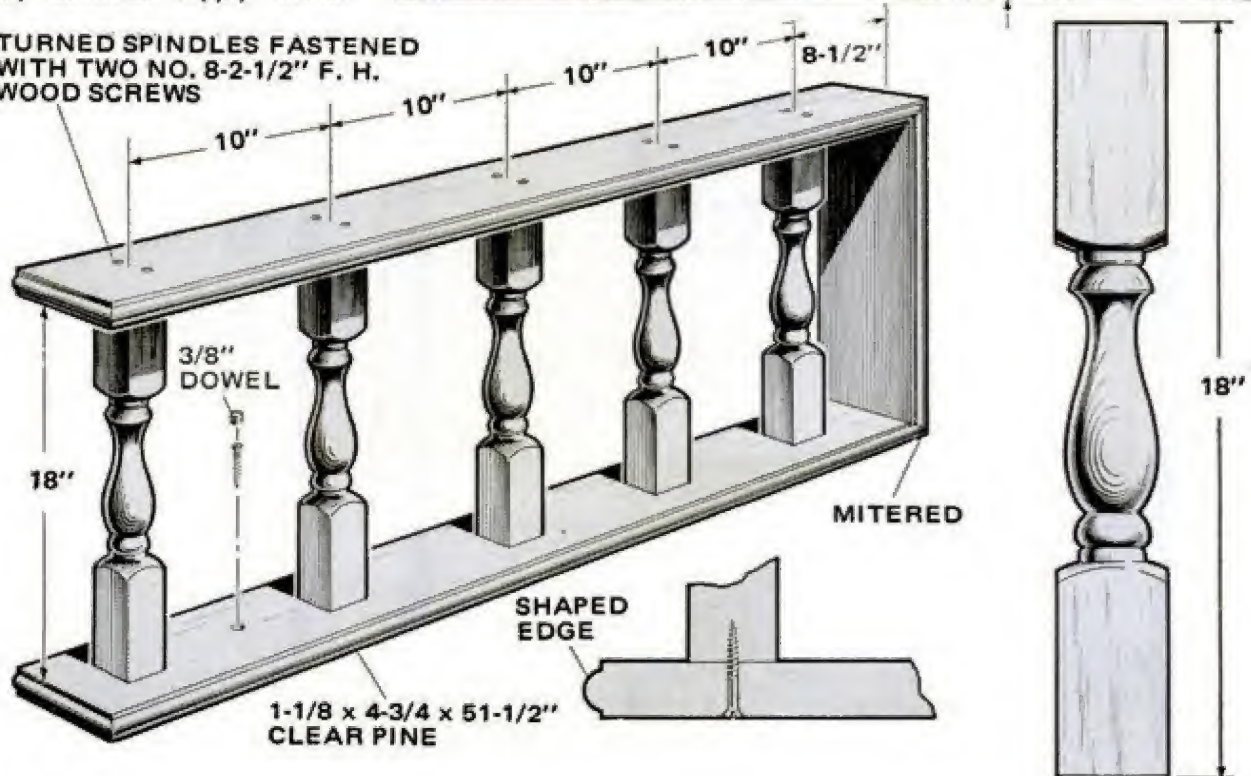
New walls. The fireplace wall was framed out to receive two cabinets (described in *An Early American Server with a Secret*, page 156, Nov. '71 PM). Then, leaving windows in place, the entire wall was skinned with paneling. Outside, the windows were fitted with



STREAMLINED LIGHT SWITCH by Slater Electric, Glen Cove, N.Y.; sold by electrical supply houses



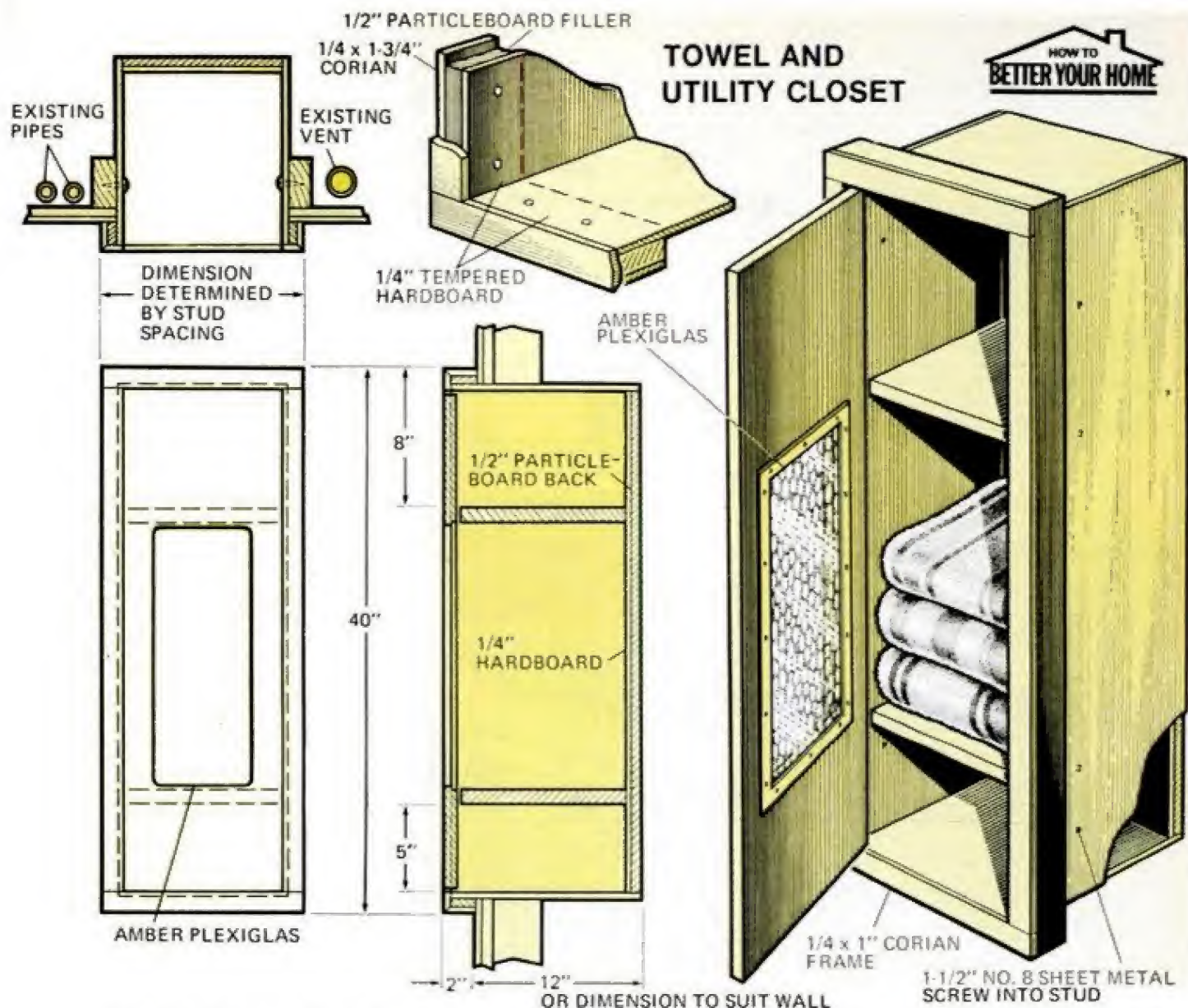
TURNUED SPINDLES FASTENED WITH TWO NO. 8-2-1/2" F. H. WOOD SCREWS



shop-made storms which are set into caulking and held by screws. The shelves on this wall are stained pieces of plywood and the edges are covered with plastic shelf edge (see moldings on page 149). Two high-hat eyeball lights on an independent switch are aimed at this wall to give sufficient light. The stairwall transformation had a big impact on the appearance of the room because it makes it seem larger. The white paneling on the outside wall is what opens it up visually. To finish, Ozite carpeting went down, wall-to-wall, to hide the old oak floor. ★ ★ ★

MATERIALS AND MANUFACTURERS

Hearth slate—Vermont Cut Slate, Inc., Fair Haven, Vt.
Ceiling—Gold Bond Brush Tex, National Gypsum Co., Building Products Div., 325 Delaware Ave., Buffalo, N.Y.
Doors—Morgan Door Co., 601 Oregon St., Oshkosh, Wis. 54901 (Model M-1075).
Ceiling and mantel beams—Lite-Beam, Haddon Ave. and Line St., Camden, N.J. (Medium colonial mahogany).
Shutters—Cannon Craft Co., Box 558, Sulphur Springs, Tex. (Prefinished with oriental inserts).
Stairwall spindles—E.A. Nord Co., Everett, Wash. 98206 (No. C318, colonial).
Chandelier—Moe Light, Thomas Industries, Box 1643, Louisville, Ky. 40201. (M2198, aged tinware).
Carpet—Ozite Corp., 1755 Butterfield Rd., Libertyville, Ill. 60048 (midnight tweed blue).
Door chimes—Nutone Div. of Scovill, Madison and Red Bank Rds., Cincinnati, Ohio 45227 (LA-19).
Hi-Hat eyeball lights—Sterling Lighting, 5691 Rising Sun Ave., Philadelphia, Pa. (R30, 75-w.).
Shelf edging—Glass Laboratories, Inc., 863 65th St., Brooklyn, N.Y. 11220 (Cyclocac plastic).



REMODELED BATH

(Continued from page 113)

mitted water seepage behind the wall covering, and the plasterboard beneath was severely damaged.

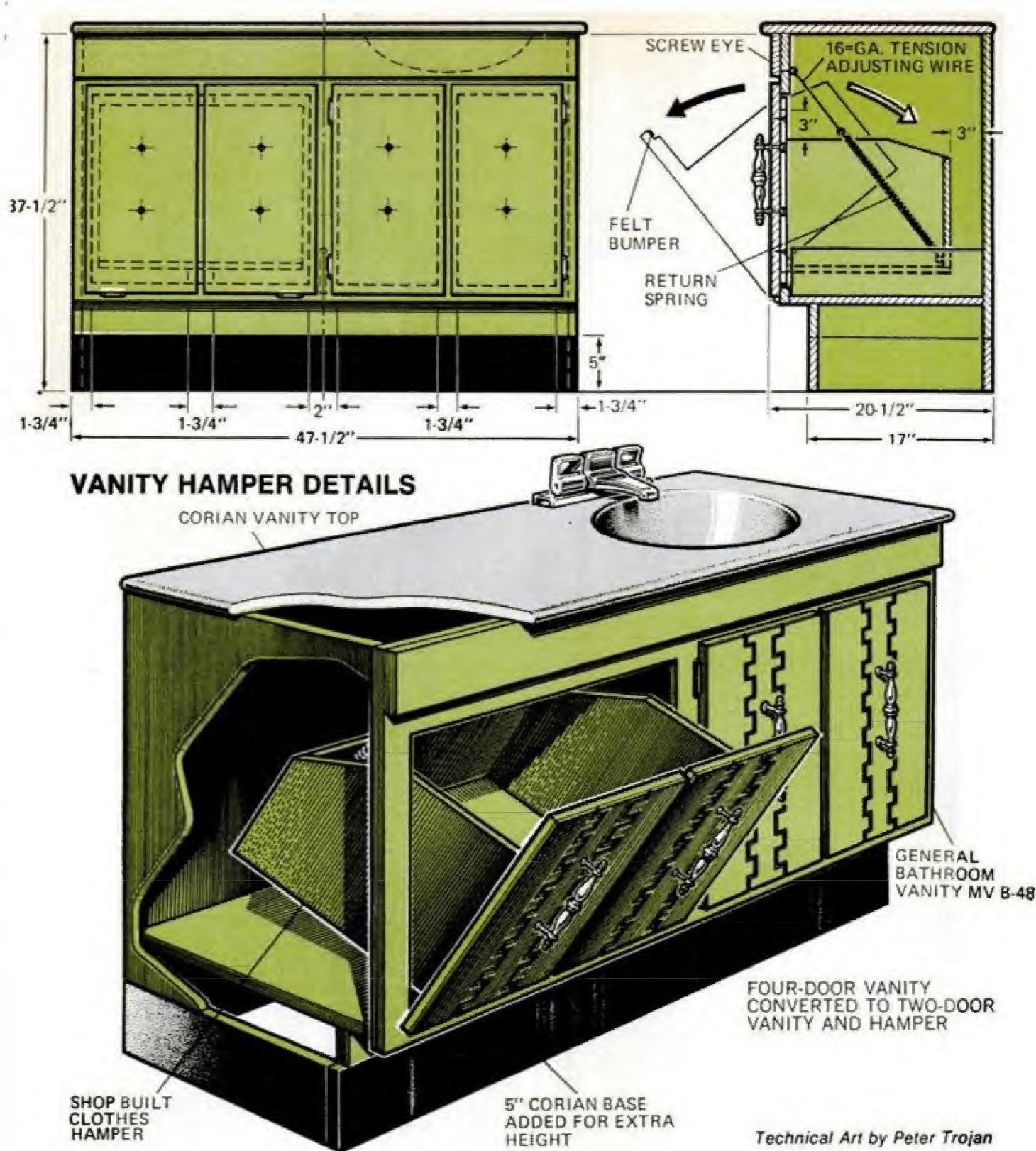
To close that drafty window, it was necessary to install an exhaust fan. The fan (with heat lamp) was wired to turn on automatically with the overhead light. And to conceal the ductwork, a suspended ceiling was installed. After replacing rotted studs and plasterboard, Gaynor used $\frac{1}{4}$ -in. Corian to cover the walls. That's a man-made plastic material that looks and feels like marble but there's a difference: It can be worked with carpentry tools. It provides a maintenance-free, waterproof room for years to come.

The bath is completely rebuilt. The only fixture remaining from the orig-

APRIL 1972



ORIGINAL VANITY (above) had dated linoleum top. New one-piece top rests on a factory-built vanity.



VANITY HAMPER DETAILS

inal room is the tub. The new toilet, as well as the ceramic floor tile, was purchased at Sears, Roebuck, and the one-piece vanity top with bowl comes as it appears in the photo. The prefinished vanity was altered slightly to provide an out-of-sight clothes hamper (see drawing) because there was insufficient space for a freestanding one.

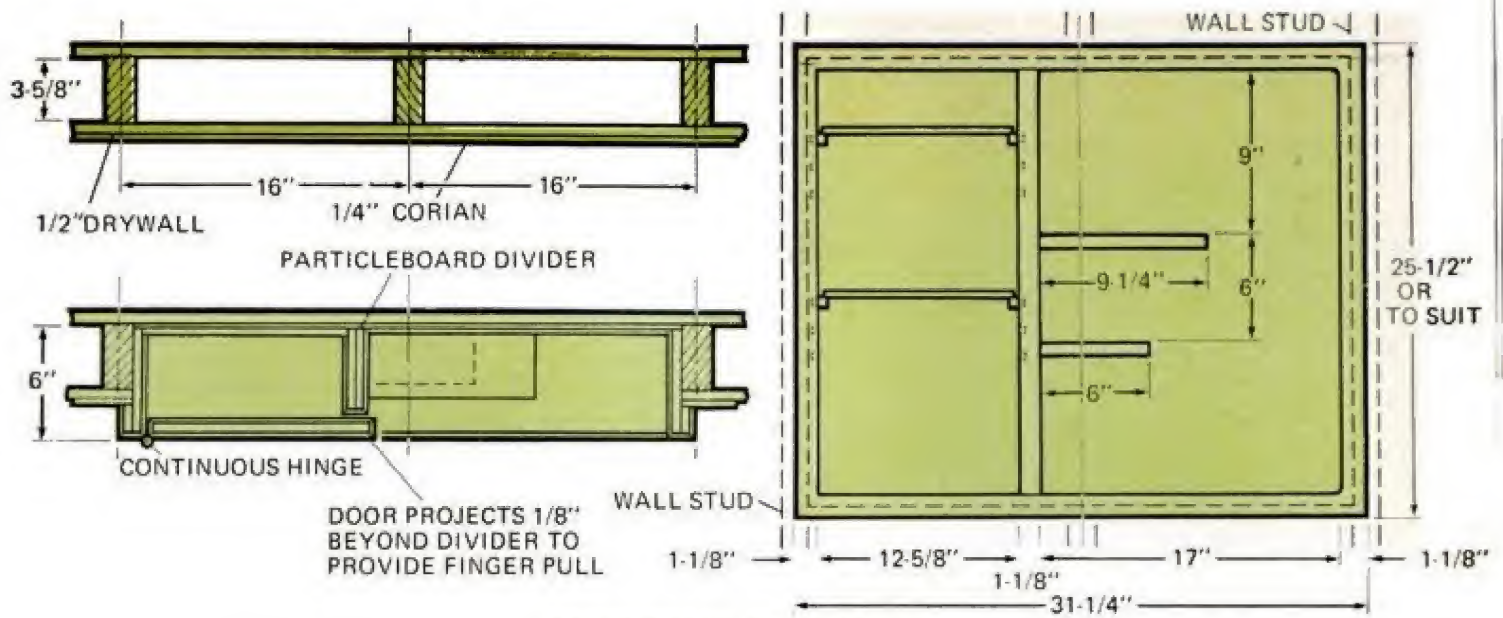
Two wall cabinets were built in Gaynor's shop. The towel closet is of Corian

and Plexiglas and the medicine cabinet is skinned with walnut laminate. How to build them, and alter the vanity, is shown in the drawings. ★ ★ ★

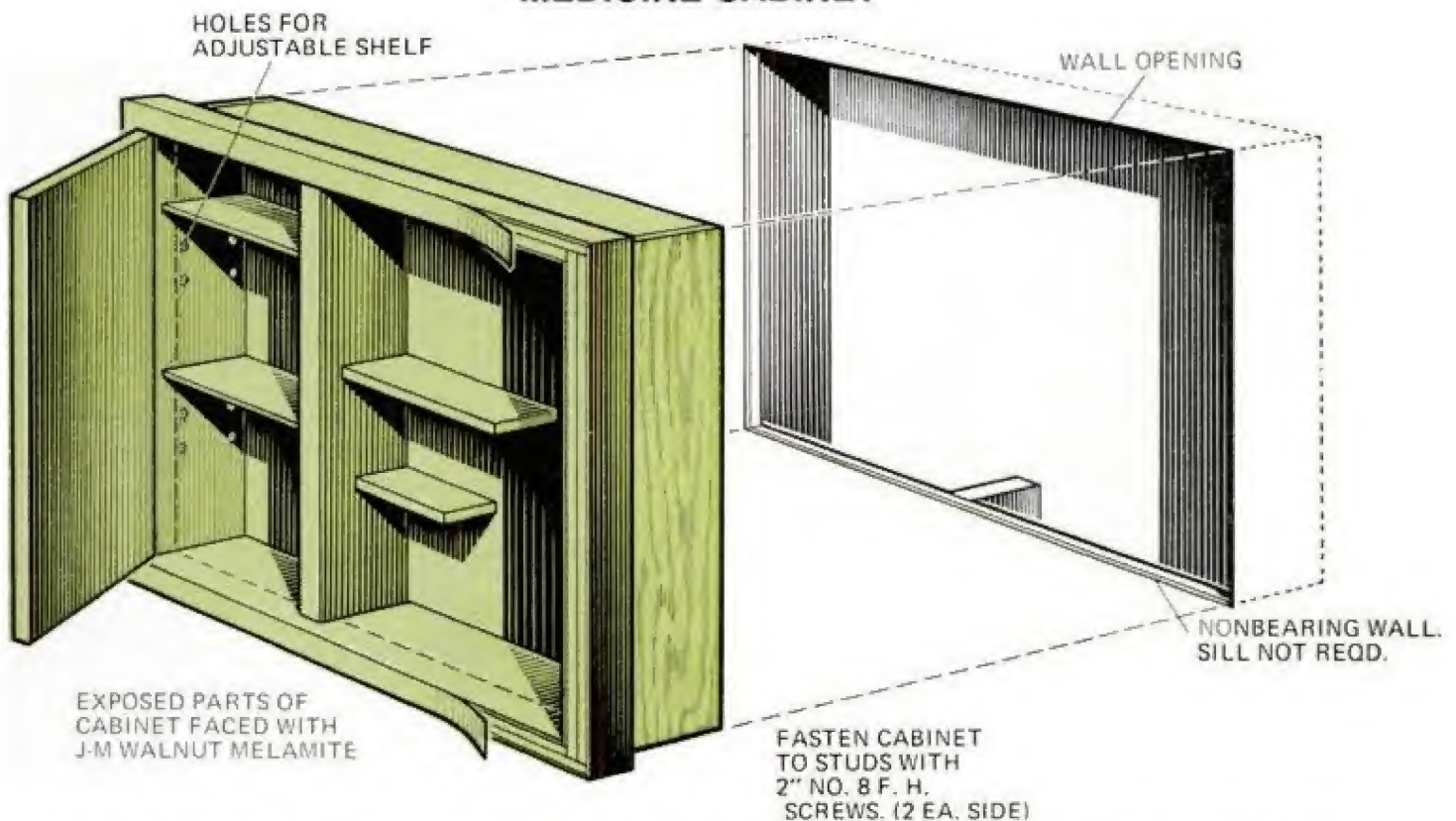
MANUFACTURERS OF MATERIALS

Corian, tub-enclosure kit—DuPont Co., Dept. PM, 3301 North Market St., Wilmington, Del. 19802.
Toilet, ceramic floor tile—Sears, Roebuck & Co.
Vanity, mirror-medicine cabinet—General Bathroom Products, Dept. PM, 2201 Touhy Ave., Elk Grove Village, Ill.
Ceiling—Armstrong Cork Co., Lancaster, Pa.
Ceiling exhaust fan—Nutone, Madison and Red Bank Roads, Cincinnati, Ohio.
Walnut laminate, Melamite—Johns-Manville (available at lumberyards and building supply dealers).

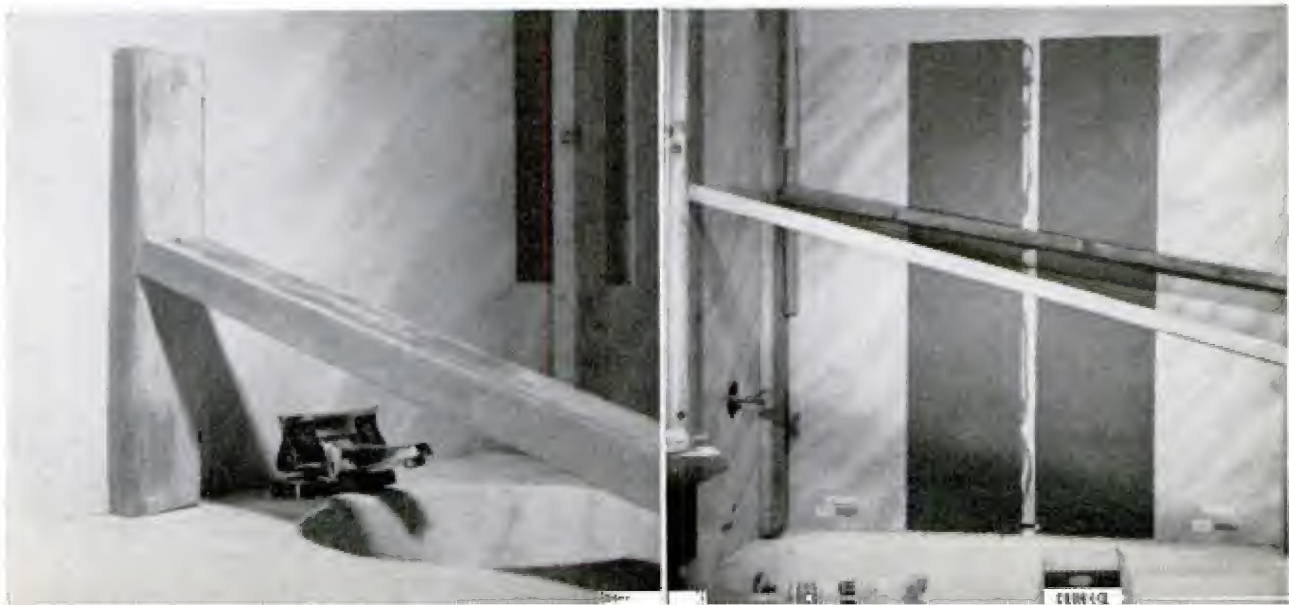
POPULAR MECHANICS



MEDICINE CABINET



PLASTIC "MARBLE," used on walls and in tub, is fastened with adhesive. To insure neat job where panels butt, bracing is kept in place until glue dries. For durability, plastic was also used to build cabinets



OVER-THE-GARAGE EXPANSION

(Continued from page 114)

rage to gain a master bedroom that was away from the existing four bedrooms. The new wing, which permitted construction of a private bath and sitting room as well as bedroom, also has Pella sliding doors that give access to a deck over the new playroom.

Inside it was decided to create a cathedral ceiling of rough-hewn cedar so the rafters were left exposed and stained. The entire room is paneled to eliminate future painting or papering problems.

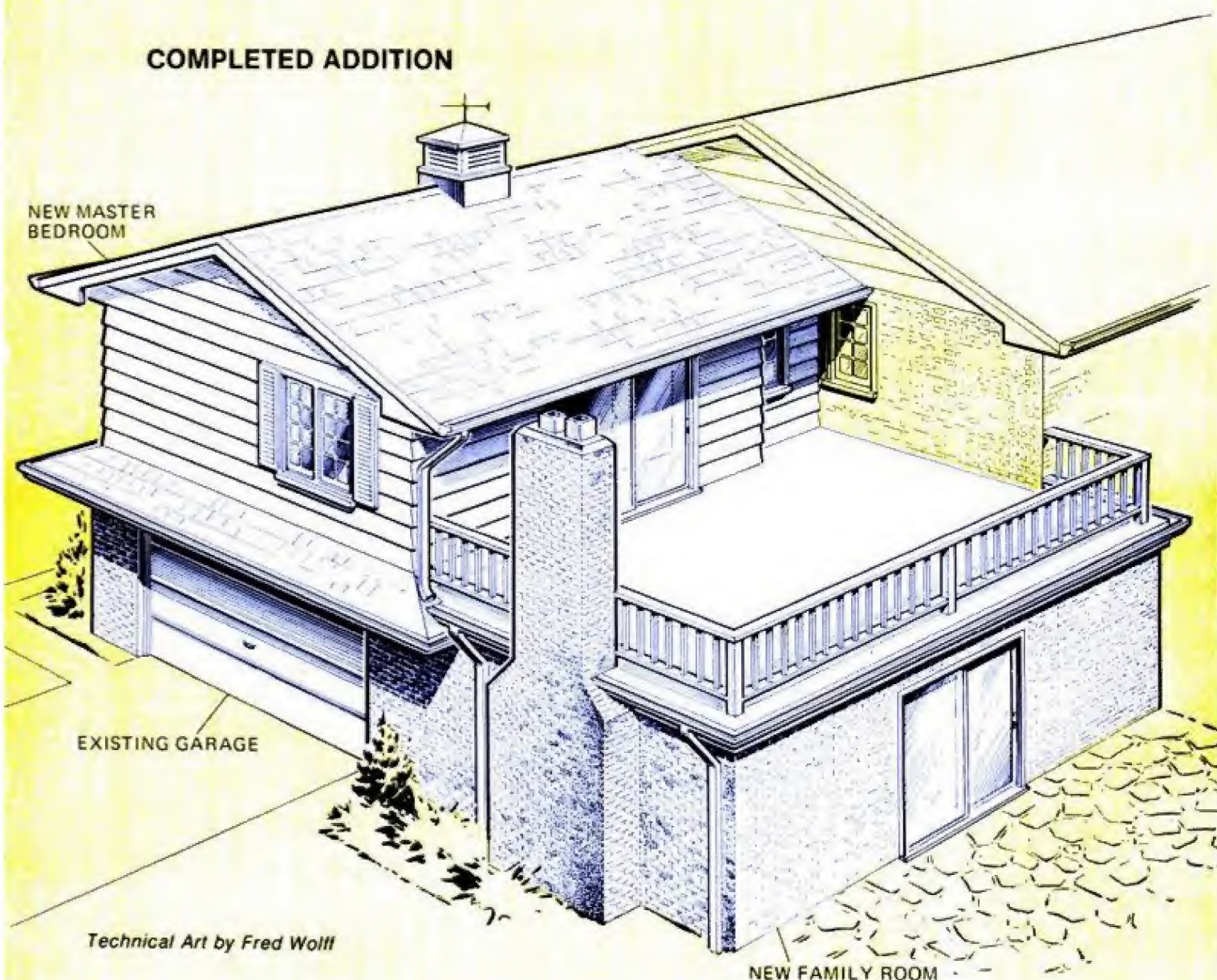
Outside, the roof pitch follows the existing structure. The result is that the addition does not look tacked on but gives the appearance of having always been there. To keep costs down, alumi-

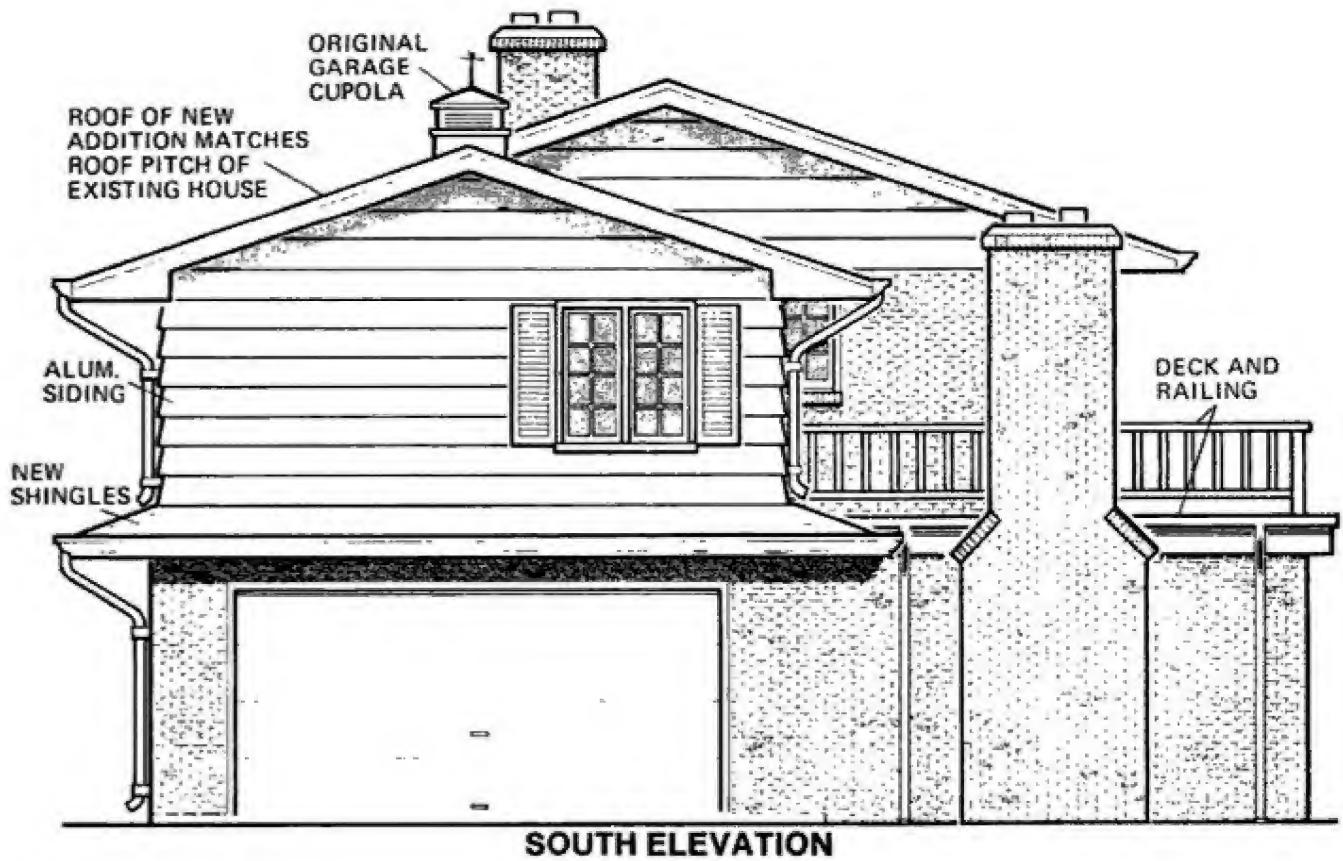
num siding, rather than brick veneer, was used.

Expanding up, when possible, rather than attaching a new structure is a practical approach to home improvement for several reasons. It is more economical because the footings under the garage are already there. Thus, excavation and concrete work are not required, and if desired, that money can be put toward interior luxuries or extras. And expanding up also leaves more yard area for outdoor activities.

Whether you decide to add both rooms in one project, one only, or one now and the second as time and money permit, the building concept the Le-Jeunes used is a sound one. Once either or both additions are closed to the weather, interior work can proceed as you—not the elements—dictate. ★★

COMPLETED ADDITION





RANDOM-SPACED
LAGSCREWS PAINTED
FLAT BLACK

HAND-WHITTLED PEGS

4x4

SHAPED
END

SHELF CLEAT

1x1 END CLEAT

1x2

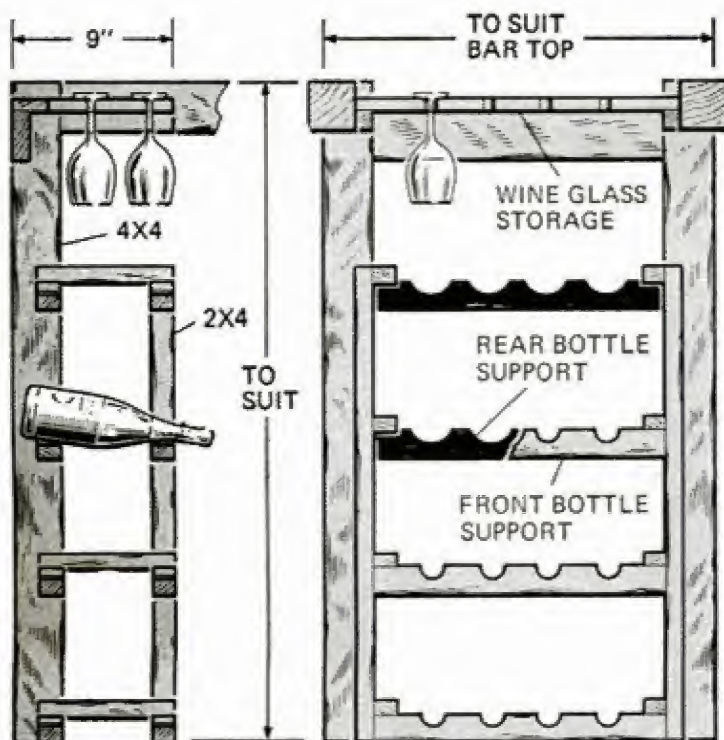
TOENAILED TO
BAR TOP

BAR TOP

STEMWARE SHELF AND WINE RACK

3/4" SLOT APPROX. 7-1/2" LONG
SPACED 3-1/2" O.C.

STEMWARE SHELF DETAIL



FAMILY ROOM IDEAS

(Continued from page 115)

room (page 115) proves you don't have to pour thousands into a project to get additional attractive living space.

Strategic placement of the bar enables the "bartender" to make use of appliances and sink in the kitchen that was already in the basement. Two elements that distinguish this bar are distressed beams and the combination wine-rack, stemware-storage shelf. Antiquing the beams is more a matter of time than skill; for effect, use a dark stain and semi-gloss varnish to finish. ★★★

Need more storage space? Make your closets work

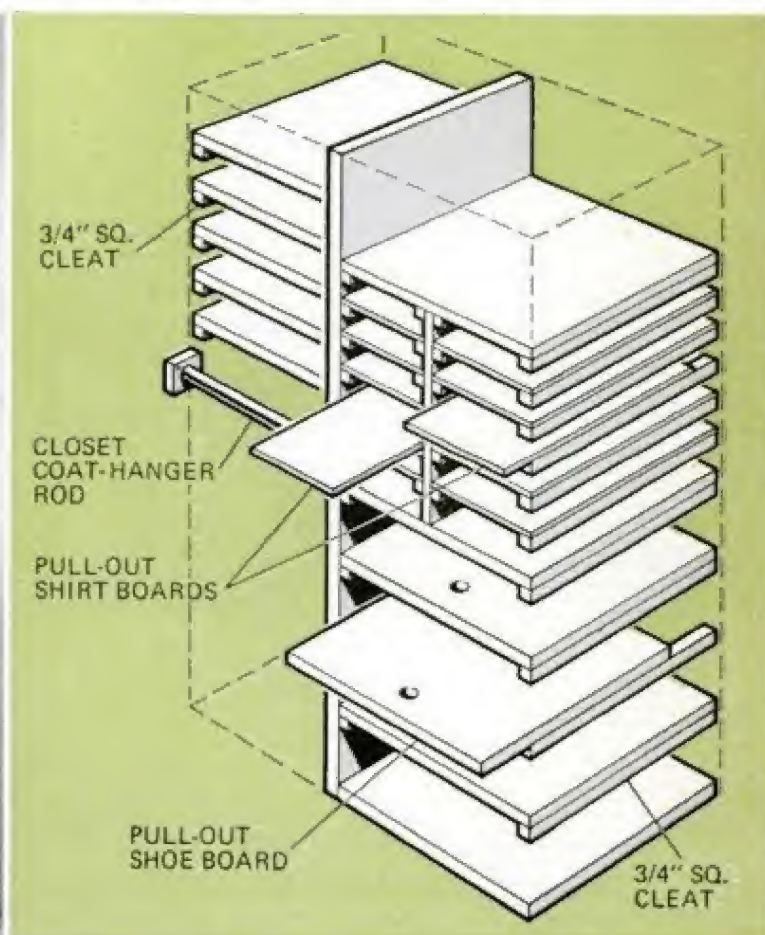
Most closets have space going to waste. Add these built-ins and sliding shelves and put those 'lazy' areas to good use

IF YOU COMPILED a list of the 10 most common homeowner complaints, insufficient storage space, both for daily and seasonal use, would be high in the ratings. And, in most cases, the complaint is justified. Even new homes show a lack of thought in design and treatment of closet construction. However, since family needs vary, exactly how to get complete use of a closet depends upon what you need to store and for what length of time.

Three good ideas shown on these

pages are all in the home of Mr. and Mrs. Albert O. Foster II of Wayzata, Minn. The bedroom closet, below, makes use of what previously was (and in most homes is) wasted space. By putting down on paper the everyday items for which they needed out-of-sight storage space, the Fosters gained a functional closet. Built as shown in the sketch below, the closet holds shirts, socks, and the like on handy sliding shelves. Extra shelves were installed above the clothes hanger rod to handle

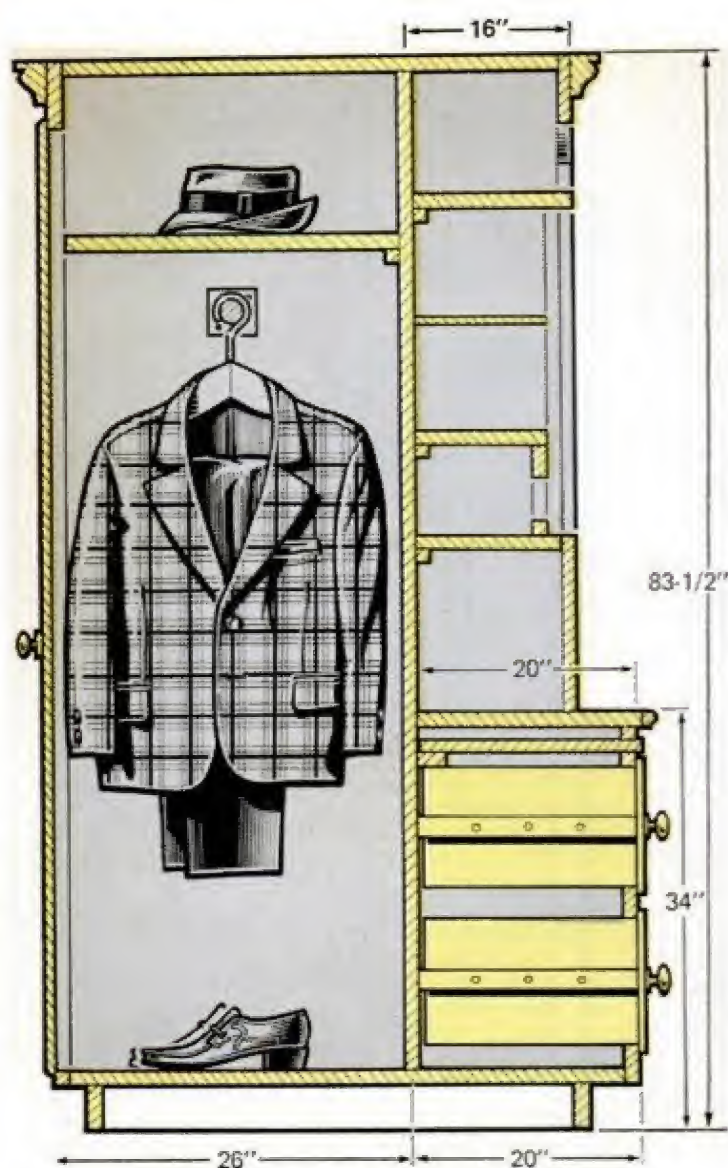
BEDROOM CLOSET has hanger space reduced and pull-out sliding shelves added to meet needs of the user





seasonal items such as heavy clothing during the summer months.

The second, and most elaborate, "closet" is the peninsula unit which was added to the living room. The project initially started as a simple wall to shield living-room users from icy



SECTION

PENINSULA CLOSET gives shelving on living-room side plus convenient hanging for coats in the foyer

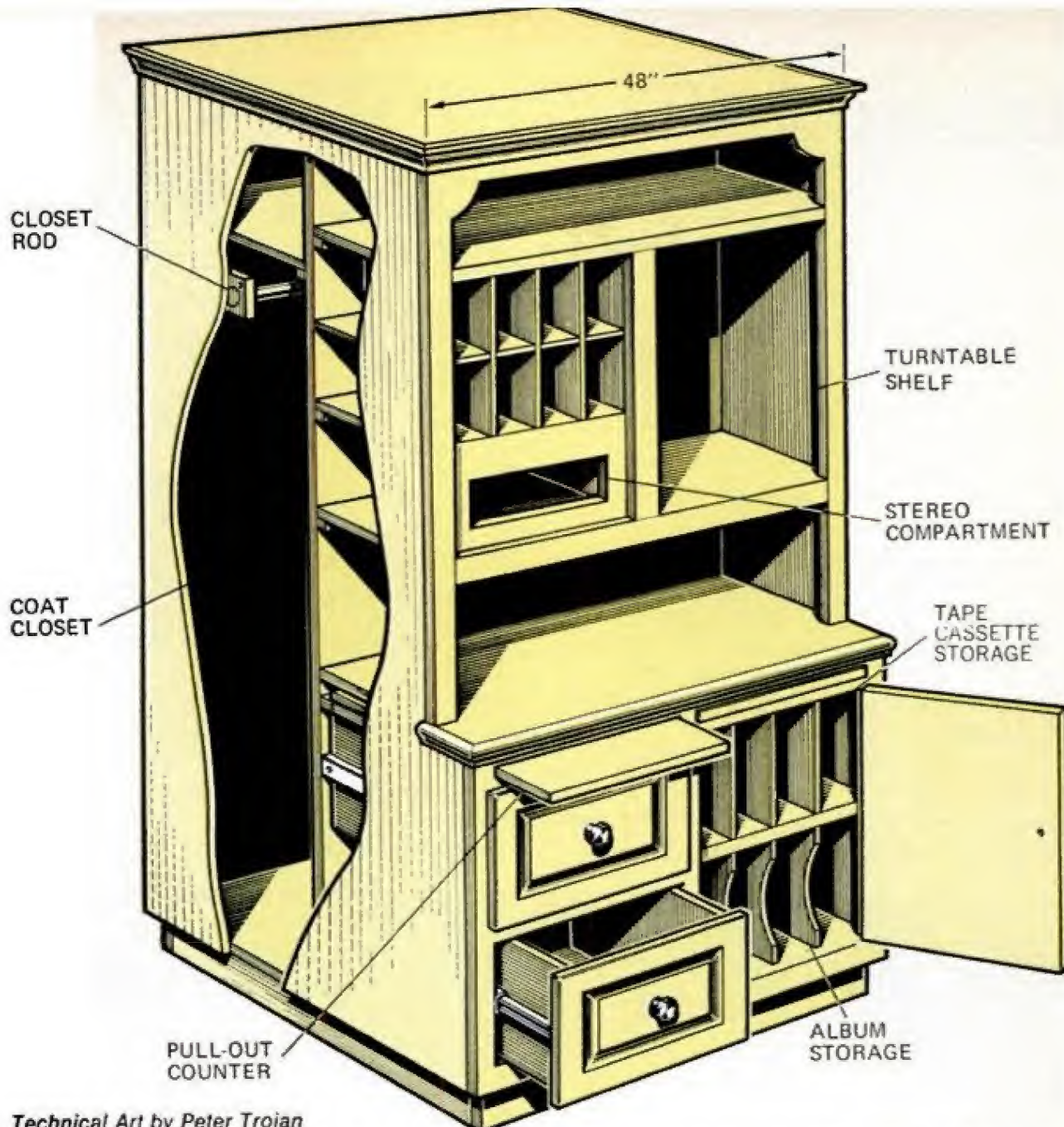
blasts each time the front door was opened. Because the living room could afford the floor space and the Fosters were imaginative planners, what would have been wasted space was used.

The front side of the unit faces the foyer and provides convenient hanging space for outerwear. The back side, facing the living room, has the look of a hutch. It houses stereo equipment, books and art objects, and also has pull-out counters for additional storage.

The third storage change the Fosters made was to add a much-needed linen storage closet in the bath. Eight 15-in. open shelves are above the counter for towels and linens. Four cubes below are where two sons store boats and other kids' bathtub paraphernalia.

Other ideas you might consider:

POPULAR MECHANICS



Technical Art by Peter Trojan

Many closets, though 4 ft. or more wide, have a single door for access. Why not install bypassing doors to permit easy access to the full closet?

Also, if it's structurally practical, don't overlook the possibility of using 8-ft.-high bifolds. These let you add shelves above that can make seasonal storage a snap. If you put the tall bifolds in bedrooms, each family member can then store his own clothing in one handy place instead of using the attic or basement. ★★★

CREDITS FOR PAGES 111-131

Data: Barbara Gorder, pages 114, 115, 129
Annette Sukov, page 111

Color photos: Robert D. Borst, pages 112, 113
Dean Paris, page 114
Les Turnau, pages 111, 115



TOWEL CLOSET convenient to sink has louvered bypassing doors to insure adequate circulation of air

Two planters for the price of one

Take one \$19 whiskey barrel, saw it in half and you'll wind up with two handsome patio planter tubs that would cost \$50

By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert D. Borst

WHILE YOU CAN EXPECT TO PAY up to \$50 for a pair of planter tubs like these, you can make a couple for your patio and save as much as \$31 by sawing a used whiskey barrel in half.

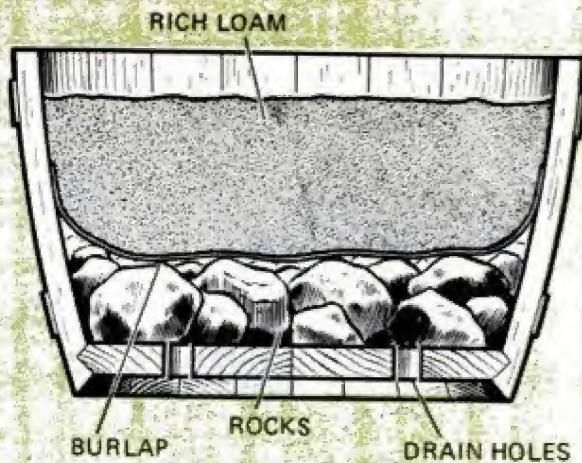
Where do you get a used whiskey barrel? You can order one from G. I. Frazier Co., Box 8275, Louisville, Ky. 40208 for \$18.75 prepaid (add \$5 if you're west of the Mississippi).

When you get it, the chances are its metal hoops will be rusty, but a little elbow grease and a wire brush will soon get rid of the rust (an electric sander

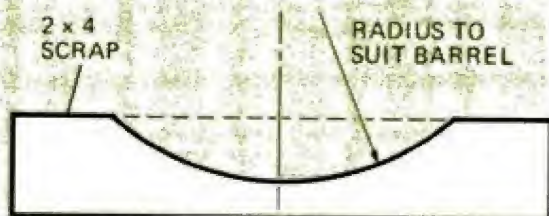
will speed the job). When you saw the barrel in half, you'll know it once held firewater because its charred interior will reek of bourbon. But this won't hurt your plants one bit; the smell will soon dissipate.

A homemade T-square with a thin bendable blade is used to mark the barrel around its circumference, and a sabre saw will cut the barrel in half quickly. Drain holes are required in the bottom of each tub, and you have a choice of painting the oak staves or sanding and varnishing them. ★★★

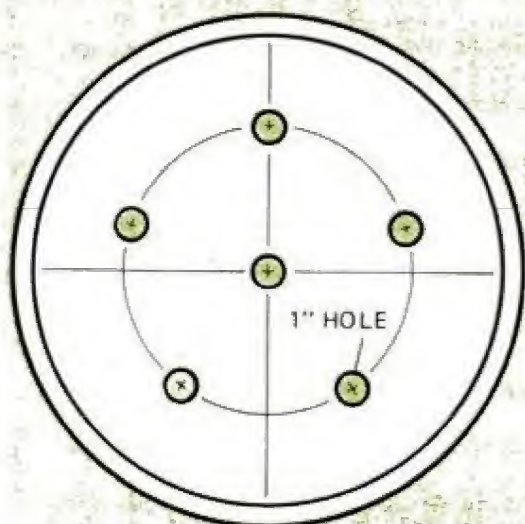




ELECTRIC SANDER and coarse abrasive paper will derust hoops in a hurry; you can also do it by hand with a wire brush. For a varnish finish, sand the staves for a new-wood look



BARREL STAYS PUT for sawing when cradled with wood blocks at each end. Mark cutting line around circumference, make a plunge cut with sabre saw, then rotate barrel as you cut



DRILL SIX DRAIN HOLES in bottom of each tub; then when you're ready to add plants, place some rocks in the bottom, cover them with burlap and fill tub with good potting soil





Farmhouse can be renovated easily for added living space and colonial charm



With the front section of the porch removed, the remaining portion provides room at the side of this house for additional first-floor living space. The house is brought closer to the ground visually by raising the level of the front grade level. The colonial entrance equipped with side lights is a stock item that can be purchased as shown at your local lumberyard. Retention of this home's colonial charm is insured by such features as clapboard siding, nine-over-nine double-hung windows, shutters and a coach-house lamp at the entry.

The major portion of the expense for this home modernization project would be the cost of replacement of all the window units.

There is no 'impossible' house

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst

WHETHER your home is 15 or 50 years old, a well-planned exterior modernization will improve its resale value as well as appearance. And if you own a tract home, you will probably be delighted to get away from that carbon-copy look. Here are five traditional homes selected by *PM's* editors for facelifting. The architect's sketches are full of ideas you can use when you're ready to remodel.

New covered deck relieves a blank look

The small ranch home at right, built 15 years ago, looks like the other homes the builder erected in the neighborhood. Converting two sliding (bedroom) windows to bypassing glass doors and adding a covered deck that conceals the garage and shelters the entry gives it a fresh, contemporary look. Andersen casement windows replace the bow window in front. Materials used to finish the exterior walls can either match or contrast with those you have in the existing house.

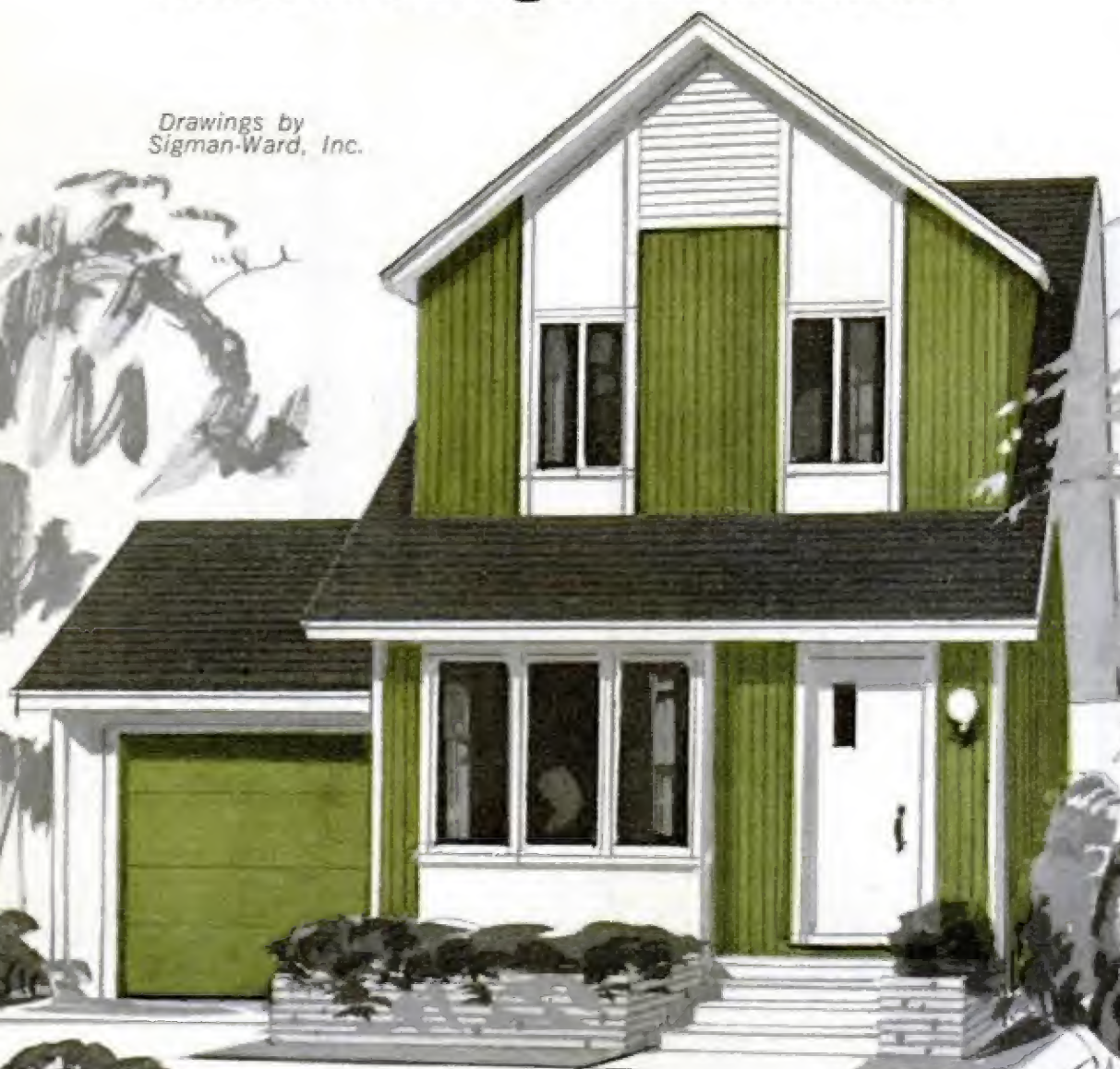




Typical frame house found in older suburban areas across the country is improved by moving the garage up the driveway and attaching it to the house. If desired, an access door between house and garage can be added for security. Though the house is two-stories-plus-attic high, the close-to-the-ground look that is popular today can still be achieved. To do it, the small patch of ground between house and sidewalk is raised and retained by a brick wall. For continuity, a planter of the same elevation appears at the right of the entry walk. Modern windows are added, and those on the second floor have textured paneling placed above up to the roof rake. For looks, attic venting louvers are extended to the ridge.

Home built in the twenties comes on strong in the seventies

*Drawings by
Sigman-Ward, Inc.*





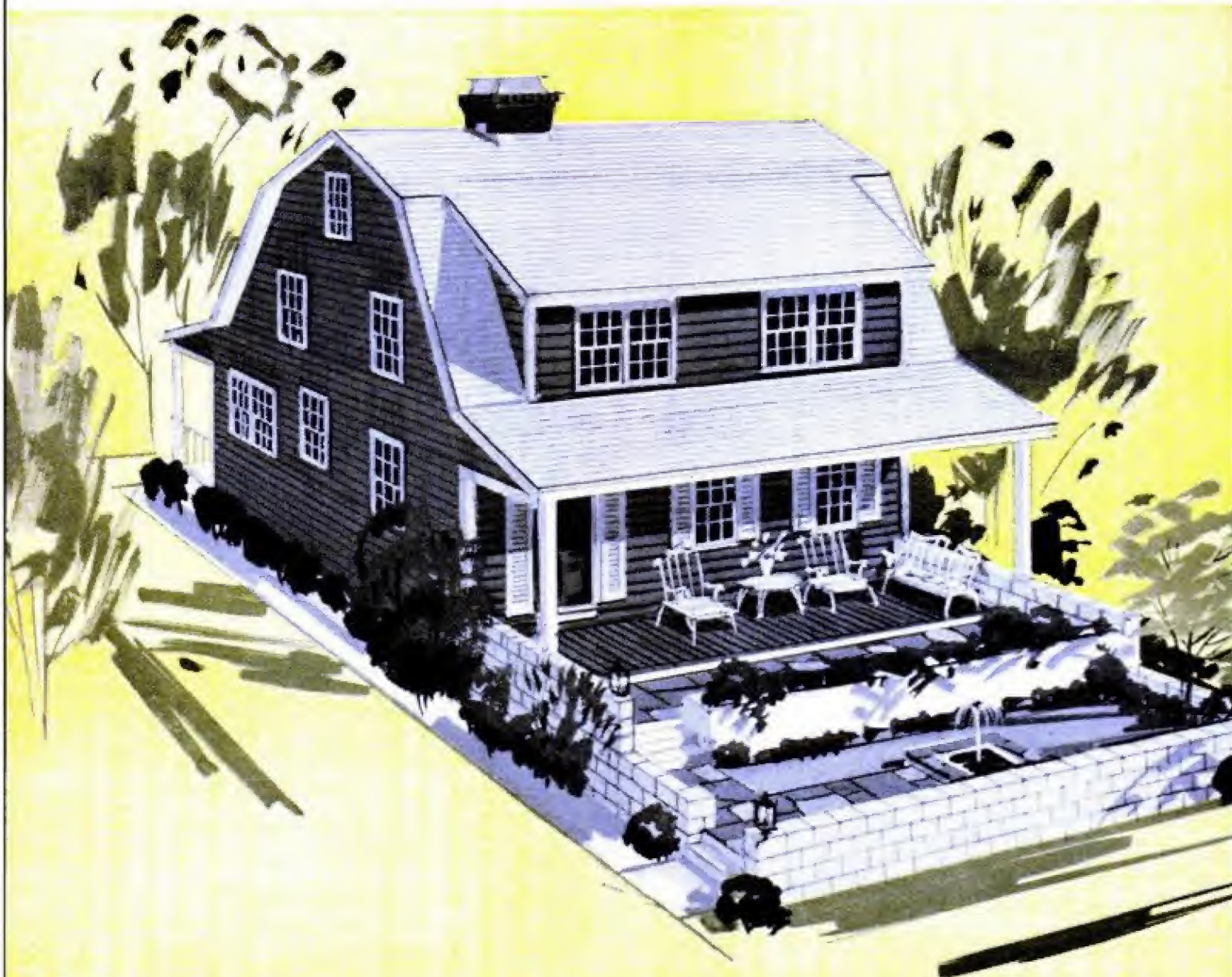
Two versions of a chalet-type bungalow

The biggest change suggested for this home is in the grade level at the front. Both designs shown above include a raised wall to create the earth-nestling look that enhances a house such as this. Structural changes in the house itself are minimal. The dormer comes of age when changed from hip-type to rectangular with a pitched roof. At the top, horizontal siding is suggested, while the smaller sketch shows the results if vertical siding is to be applied. In both designs, larger win-

dows replace the existing windows on both levels to let in more light.

Since the original house was neat, trim and well-maintained, and our aim was to do a "facelift" with architectural improvements, the use of modern materials brings it up to date.

For that reason, any homeowner contemplating an exterior renovation should first visit his local lumberyard to keep abreast of the exciting new materials now being produced for house exteriors.



'House remodeling' calls for landscape architect



The basic design feature of this house—its gambrel roof—is desirable and one that should be retained. Thus, house-face-lifting here is minimal: A suitable size beam is snaked up under the porch roof so that the two interior posts can be removed. From there on, it is a matter of bringing the house down to earth via two new grade levels. To do it effectively, we designed the area at front for summer outdoor living. Thus, such niceties as an outdoor garden pool with fountain and raised planters are suggested. Walls can be of block or poured concrete, but for a more elegant look, they should be veneered with brick. Since plantings are important, select them with care. ★★★



COOL IT with a power roof ventilator

This automatic fan pulls trapped heat from the attic to keep your home cooler day and night. It's thermostatically controlled and easy to install

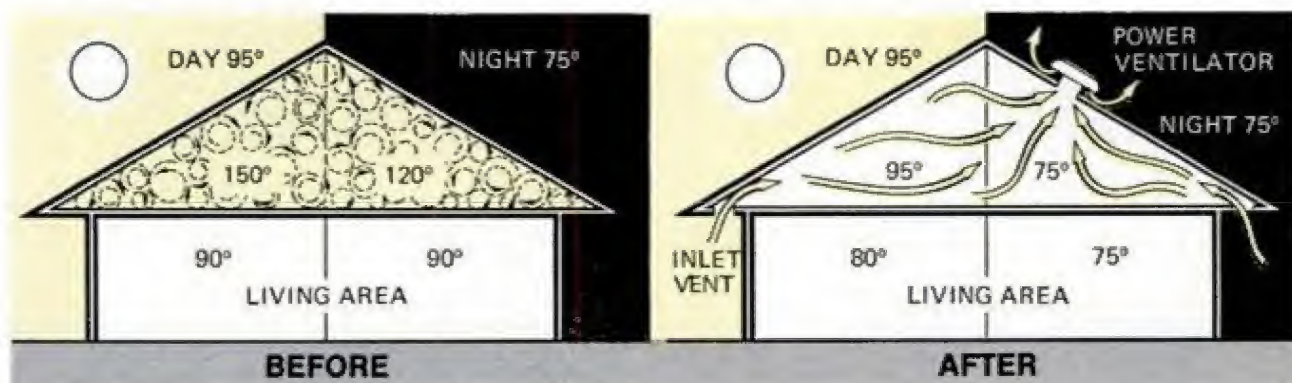
By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert D. Borst

EVER WONDER why the house stays so blasted hot even after the sun goes down? Why the air conditioner has such a hard time keeping the house cool?

It's easily understood when you realize

that superheated air trapped in the attic is often as much as 60°F. higher than the temperature outside. When night air might be 75°, attic temperature could still be as much as 120°F. This blanket of





1. AFTER PLOTTING POSITION of fan on roof, drill guide hole from attic to center fan between rafters

superheated air penetrates downward into the living room and sleeping areas and keeps the whole house uncomfortably warm both day and night, putting your airconditioning system under a severe handicap. Attic temperatures often reach 150° or more during a normal summer day.

To prevent a buildup of furnacelike heat in the attic you need to draw out the hot air as it's generated. This is done with a power ventilator that's thermostatically controlled. Set to turn on automatically when the attic temperature reaches 110°F., the fan will run until the

5. DRAW SECOND CIRCLE 15 in. in diameter with the compass on roofing paper inside the cleared area



2. USE HOLE IN ROOF as reference point and draw a 27 $\frac{3}{8}$ -in.-square outline on shingles with crayon

temperature is reduced to approximately 96°F. A cool attic means a cooler house day and night, and it is claimed that the lower room temperature will reduce air-conditioning load as much as 30 percent.

Not only will a power ventilator keep your house cooler but it will reduce the possibility of spontaneous combustion in the attic. It will also prevent excessive heat and moisture from deteriorating attic insulation and even the shingles on the roof.

Operating on a preset thermostat, one Vent-A-Matic power ventilator will adequately cool a home having up to 2000 sq.

6. SAW THROUGH ROOF following the 15-in. circle, then slide flange of fan housing up under shingles





3. MAKE WOOD COMPASS and, using hole in roof as a pivot point, scribe a 17 $\frac{3}{4}$ -in. circle on the shingles



4. CUT HOLE THROUGH SHINGLES only with tin shears, then clear the shingles from inside the circle

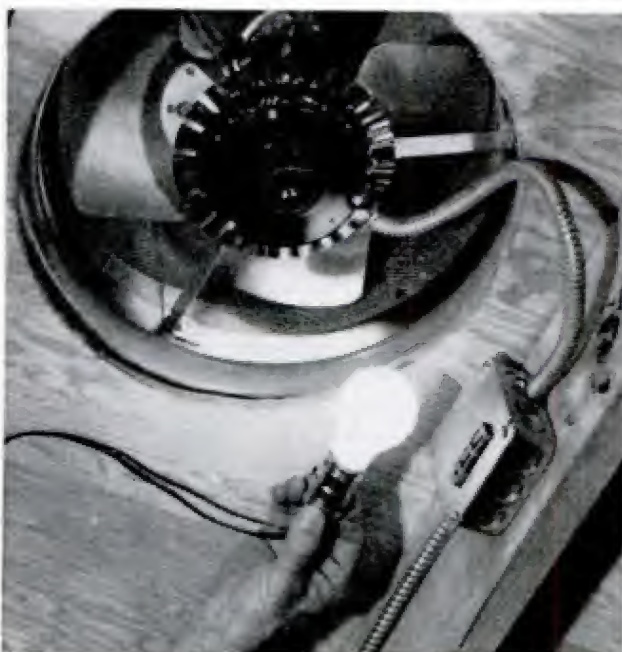
ft. of living space. Its 14-in. fan does the best job of pulling out the excessive heat when the attic has at least 300 sq. in. of air intake located along the eaves.

The fan is enclosed in a housing of Cycloc ABS plastic, a durable space-age material that will outlast sheet metal and never needs painting. The ventilator is made by the Butler Engineering Co., Box 728, Mineral Wells, Tex. 76067, and sells for \$84.95. It measures 27 $\frac{1}{2}$ in. sq., has a dome 8 $\frac{1}{2}$ in. high and is operated by a 1/10-hp, 115-v. motor.

The photo sequence shows how the unit

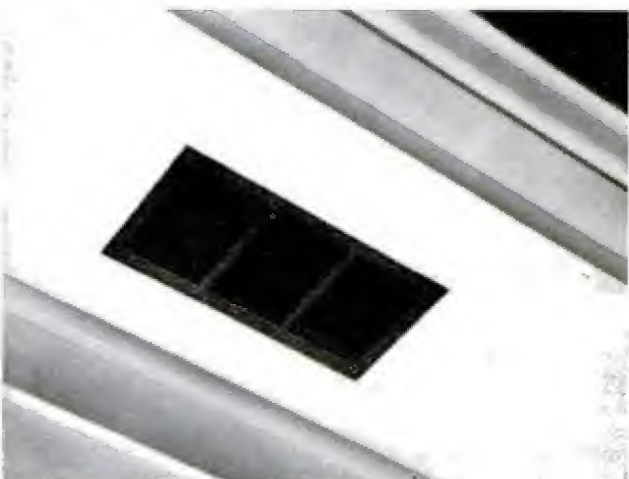
(Please turn to page 198)

7. AFTER WIRING, check thermostat with 60-w. bulb to determine if it is cycling the fan properly



AIR INTAKE IS IMPORTANT

Unless you have adequate air intake through which cooler outside air can be pulled into the attic as hot air is exhausted, you can't expect maximum efficiency from your power ventilator. Best location for air-intake vents is in soffit of roof overhang. Openings are sabre-sawed (above), then capped with louvered cornice vents (below) made by Macklanburg-Duncan Co., Box 25188, Oklahoma City, Okla. 73125. Vents about \$1 each, come 4x16 and 8x16 in.



Bright, low-cost lighting idea

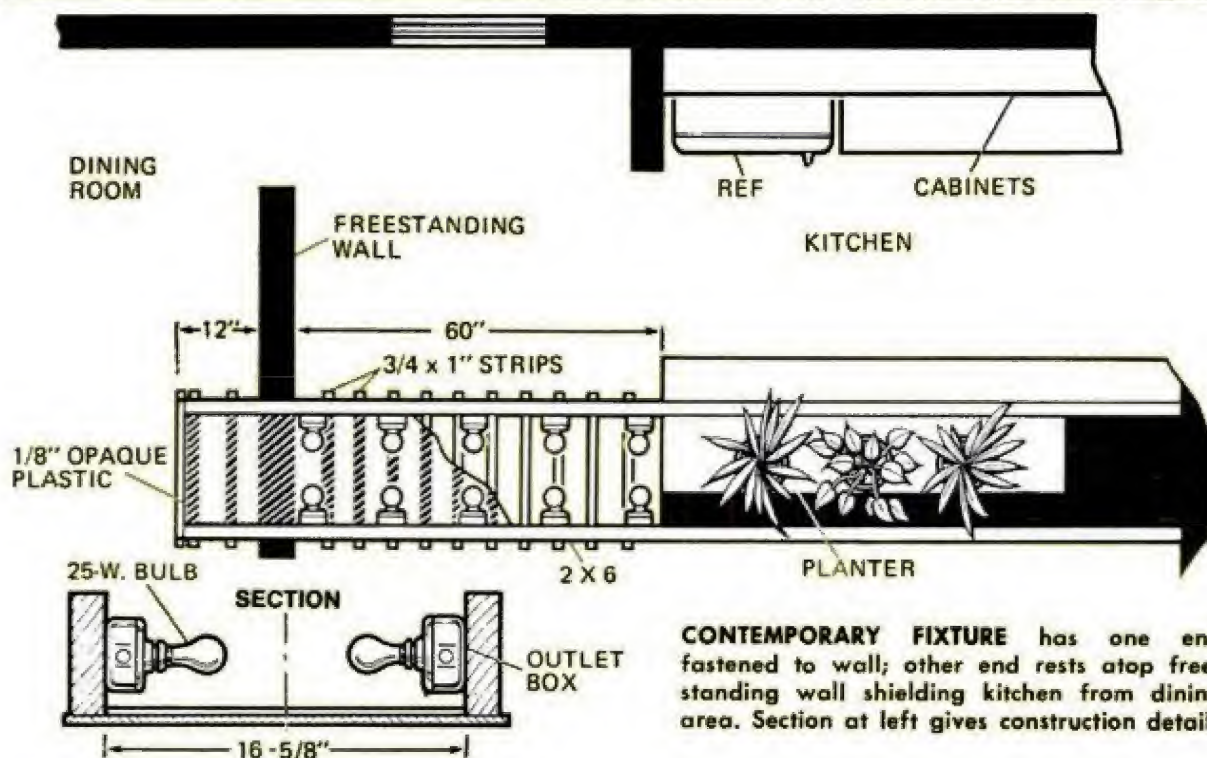


WHEN ARCHITECT Juris Curiskis of Edina, Minn., wanted to add a light fixture over a freestanding wall he built, he found that what he needed would cost about \$200. Even at that price, selection would have been a compromise, so he designed and built this handsome fixture.

Instead of the usual fluorescent fixture, 10 incandescent ceiling receptacles are used. These provide the warmer lighting the owner wanted and cost less in the long run. Conventional wiring is used to

build the fixture. Receptacles are mounted on 4-in. junction boxes and BX cable runs from box to box.

Fixture length is determined by need. In the 7-footer shown, 10 *low-wattage* bulbs were used, spaced equidistant and staggered on opposite sides. The frame consists of two 2x6s held together by $\frac{3}{4}$ x1-in. strips on the bottom and ends. The translucent sheet plastic simply rests on the strips. The end piece, of course, is secured with cleats. ★★★



CONTEMPORARY FIXTURE has one end fastened to wall; other end rests atop free-standing wall shielding kitchen from dining area. Section at left gives construction details



If you need a direct route to your basement...

... install a prefabbed stairwell. Unlike cellar stairs of old, they're now watertight, burglarproof and maintenance-free.

By HARRY WICKS, Workshop Editor

ANY MAN with a basement workshop can quickly count off the advantages to be gained by installing an outside—direct-access—basement entry such as the one shown above. By adding this convenience to your basement you can:

- Haul lumber down to your shop effortlessly, even when the materials include 4 x 8 sheets of plywood.
- Tackle almost any-size project because you won't find yourself—as cartoonists like to depict, for example—with a completed boat in the basement instead of in the water.
- Quickly store large items such as patio

furniture and storm windows in the basement where you can work on them in comfort during the off season.

From the family viewpoint, direct access is especially important if you have a swimming pool or basement playroom. Related equipment and furnishings can then be toted in or out without any traffic through first-floor rooms. And, perhaps most important, direct-access will give you a fast route to safety should an emergency arise.

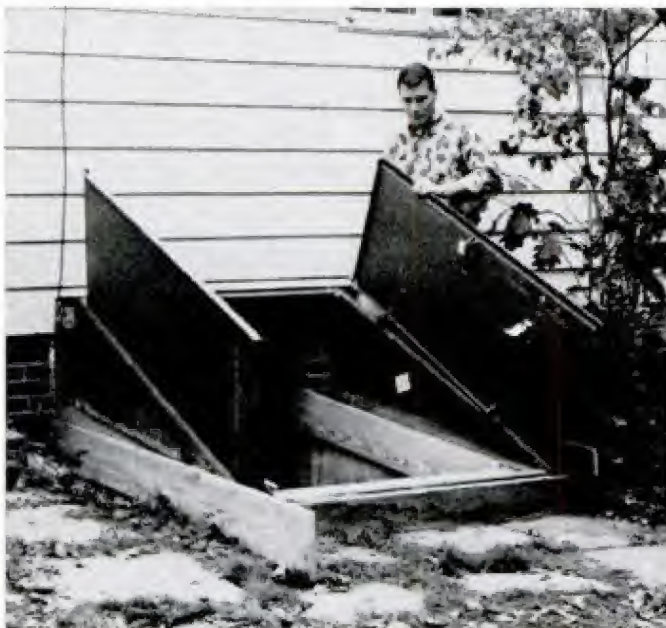
Aside from the obvious advantages of a steel installation (termite protection and minimum maintenance), the doors



DOOR FRAME is placed in its installation position and siding is marked along top to determine where to cut it



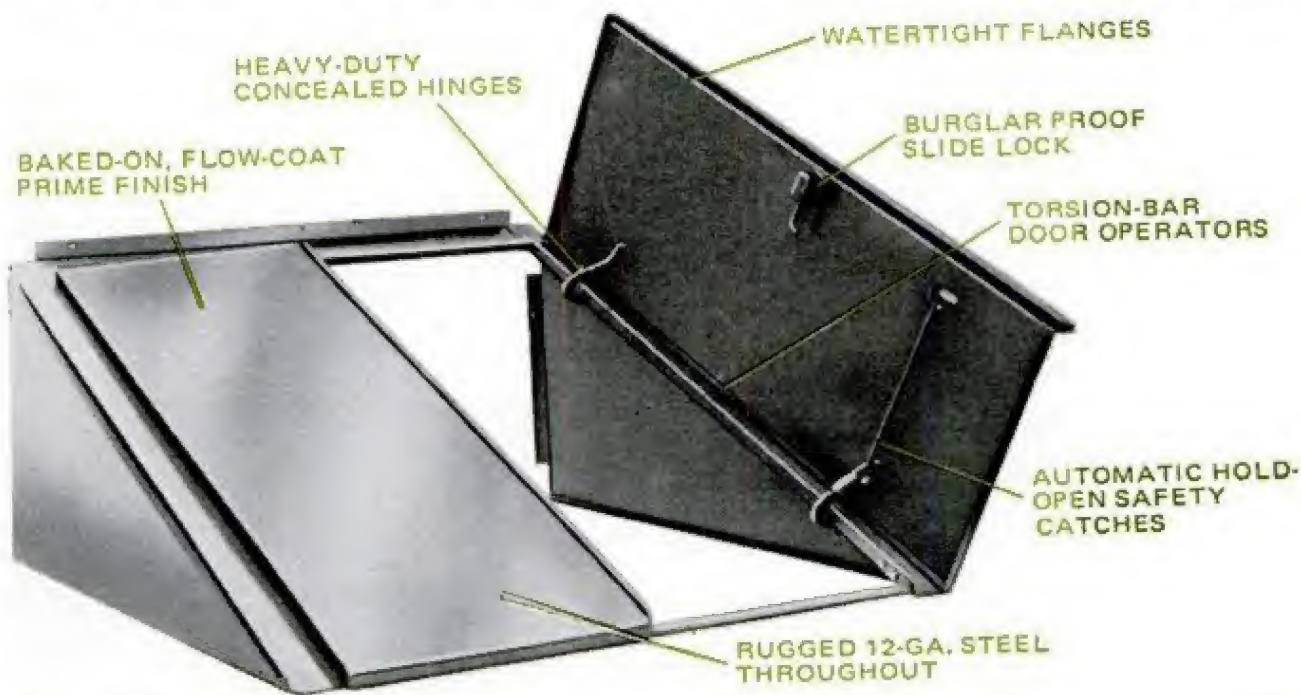
ENTRY IS POSITIONED, fastened to new foundation; joint dressed with mortar where needed



CONCRETE is allowed to set before you engage the torsion bars in clips attached to the entry sidepieces



PITCHED CONCRETE LEDGE gives positive water runoff and makes lawn edge trimming a lot easier



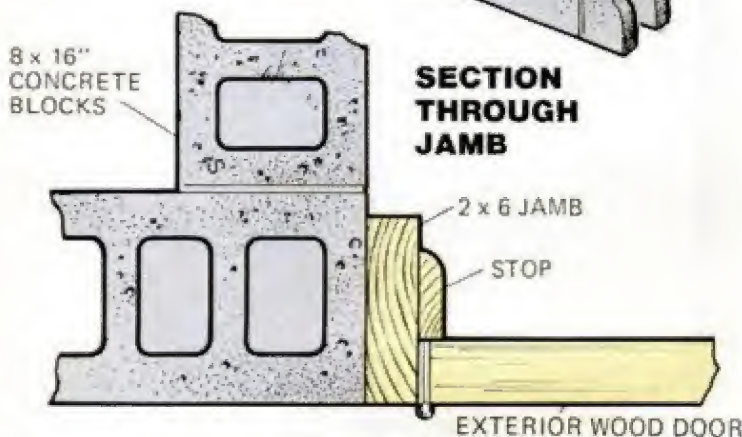
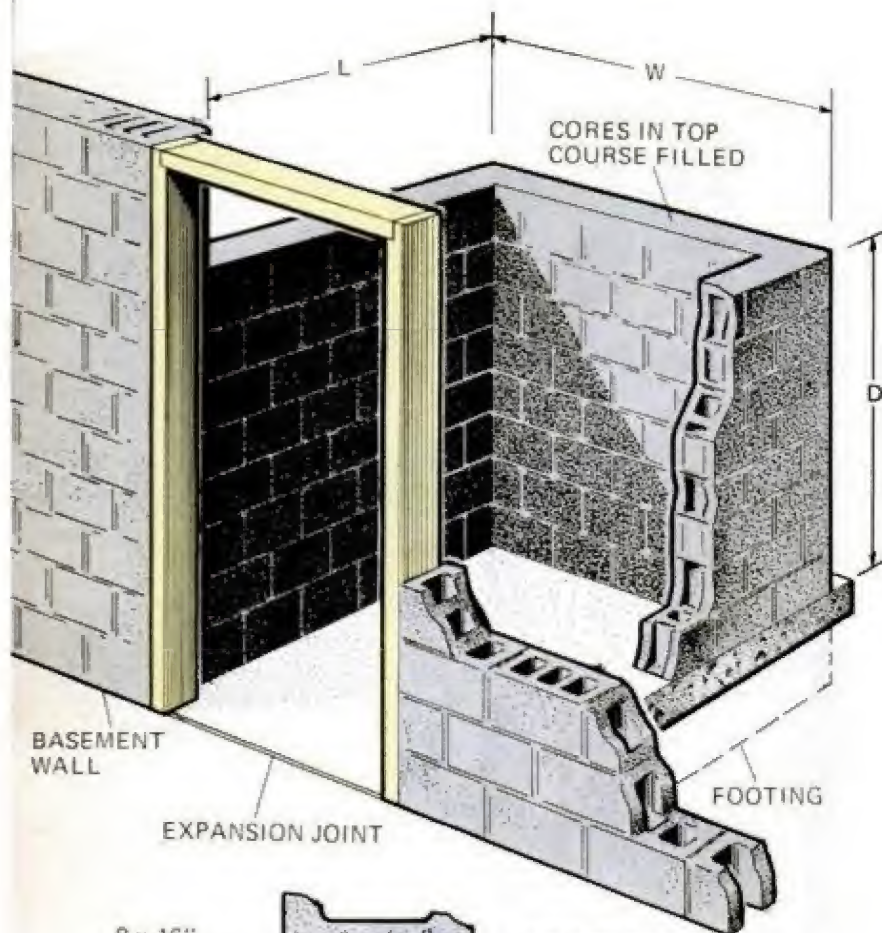
shown, which are manufactured by the Bilco Co., Dept. PM, Box 1203, New Haven, Conn. 06505, offer an additional good feature: When a particularly heavy, or bulky, item must be moved in or out of the basement, treads can be quickly removed so the object can be passed through easily.

Location of the entrance is important. If possible, it should go where the outside grade is lowest. This cuts down on the materials needed as well as the number of steps you will have to climb. And, of course, make certain that the finished grade slopes away for proper drainage. Dig the hole large enough to take the new foundation plus an extra foot all around to allow for waterproofing and

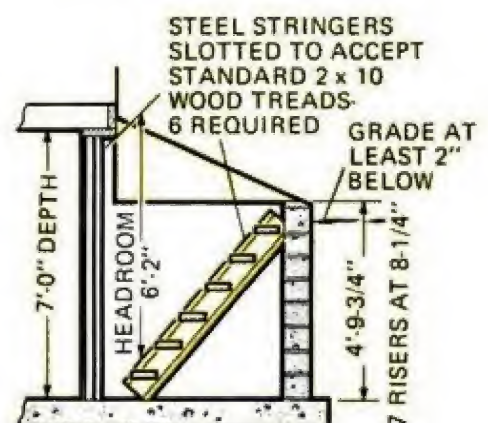
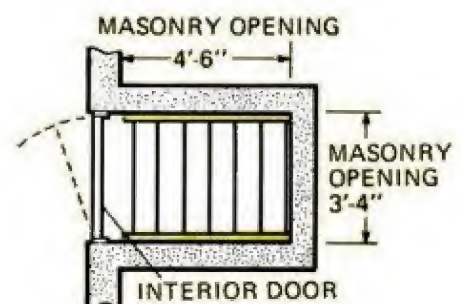
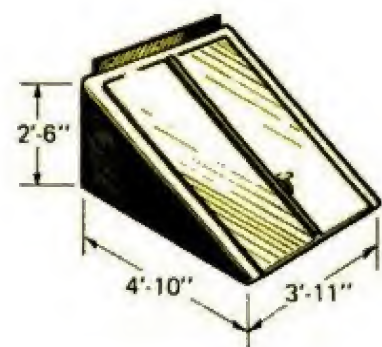
the footing. It is best to do the digging in stages, cutting the foundation as you go. This permits safer and easier handling of the cutting tool.

Electrical tools for cutting through a poured foundation can be rented from a local mason supply house or tool-rental outlet to speed up this step. A good tool for the job is Skil's Roto-Hammer which both rotates and hammers and comes with a variety of bits. The chisel attachment for example, will remove large sections with less rubble. If you have a concrete block foundation, cutting will be easier.

After excavating and breaking through the foundation, a 12-in. concrete footing goes in to provide a firm, level base for the first course of block. Simply dig a



SIZE O



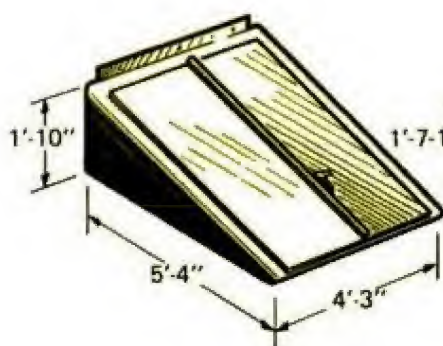
12-in.-wide trench 4 in. deep and pour the footing without forms. The top course of block should be about 4 in. above ground. After stuffing the hollow-block cores with heavy paper, trowel on a concrete cap and insert anchors as required.

Assembling the doors in place will save work. Here, make certain that the caulking strips provided are inserted between the header and sidepieces. Installation is not difficult if you read and follow the instructions packed with the doors. It's a must to follow them closely in order to validate the maker's guarantee of a weathertight door. ★ ★ ★

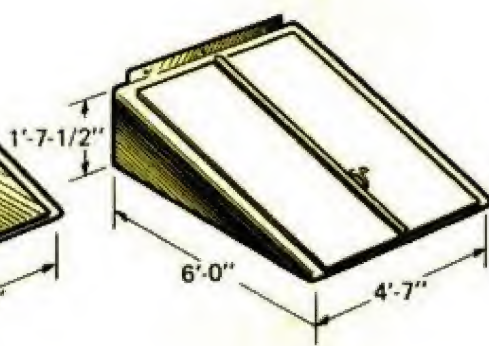
ALL HARDWARE, including steel step stringers, comes with doors. Owner supplies 2x10s used for treads



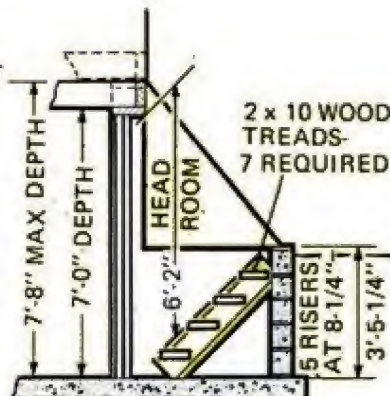
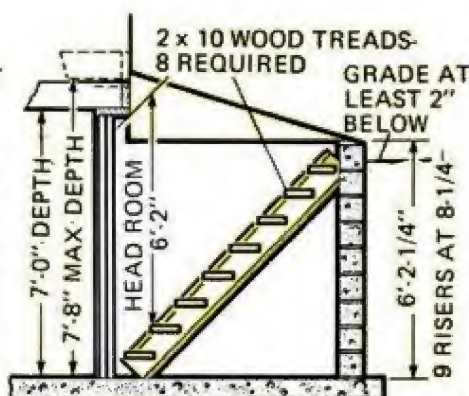
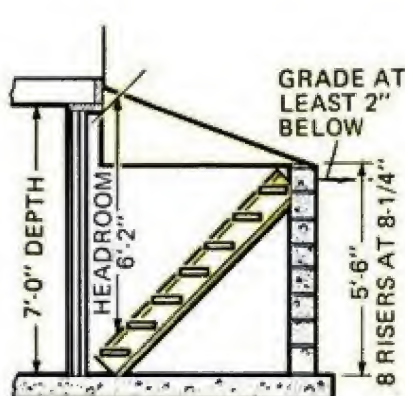
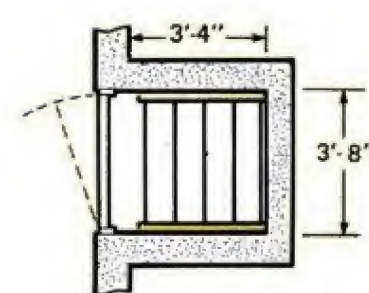
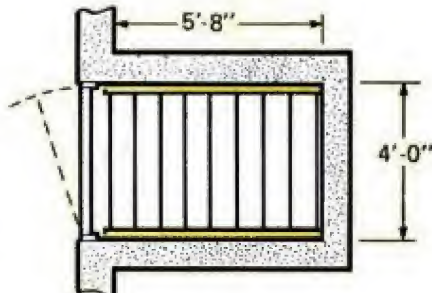
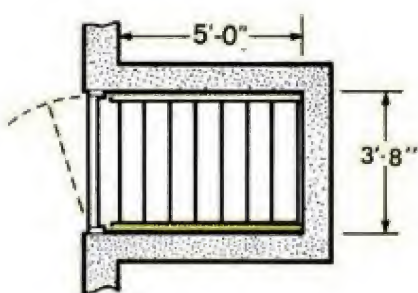
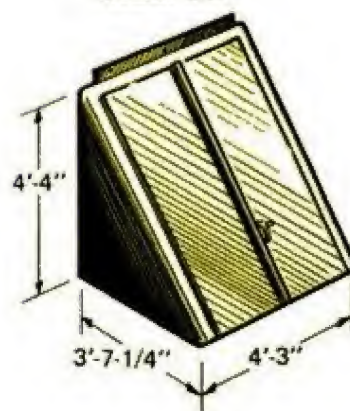
SIZE B



SIZE C



SIZE SL



New building products

PM editors select the latest



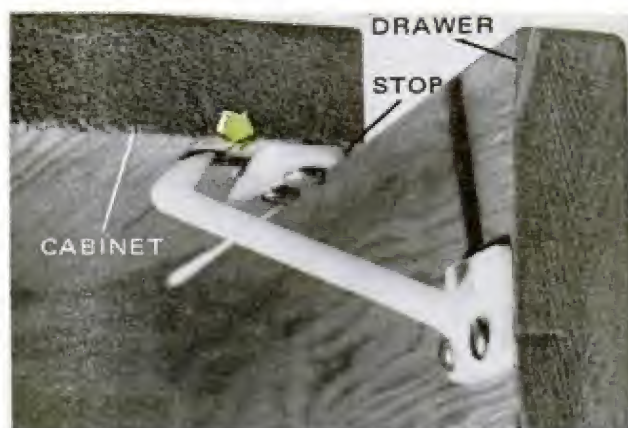
DOOR CLOSER from the Hager Hinge Co., 139 Victor St., St. Louis, Mo. 63104, is easy to install because it simply replaces one hinge pin on the door (3½ and 4-in. hinges only). Available at hardware stores, Door Closer CD-214 is priced at \$3.49, can be used effectively on doors weighing up to 60 lbs. Package includes a tension adjustment wrench.



INTERIOR PREHUNG Vinyl Shield door units include a vinyl-wrapped split jamb, casing and stop, plus a matching vinyl door offered in four wood-grain patterns—maple, walnut, Tudor oak and driftwood. Once installed, job is complete because finishing is eliminated. In 1⅜ and 1¾-in. thicknesses, they're by Georgia-Pacific, Dept. PM, Portland, Ore.



STEP BY STEP you can install the Circle Stair which consists of individual welded iron modules that slip over a pipe column, then screw together to make a simple but sturdy assembly. Steps are wood. Standard height is 97½ in. but can be made any height. Stair sells for \$299.95 f.o.b. Toce Bros., Box 489, Broussard, La. 70518.



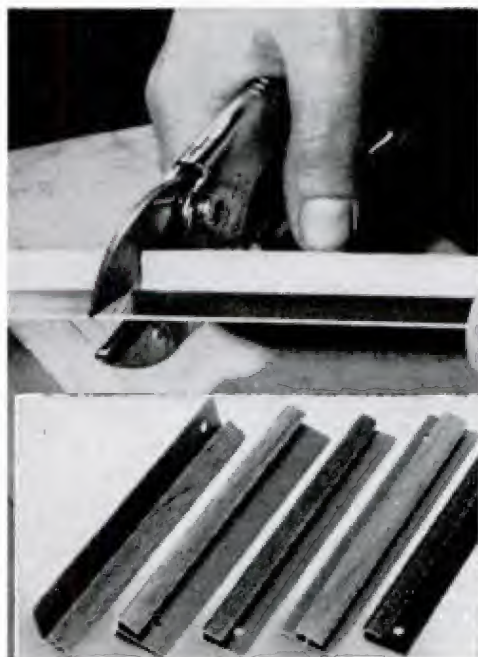
PROTECT TODDLERS from harmful and toxic home products by installing a Child Guard Latch on drawers and cabinets. This plastic device limits the drawer opening to a space needed for an adult to insert a finger to depress and release it. \$1 plus tax for two Guards. Mission Enterprises, Goliad, Tex.



ALUMINUM THRESHOLD provides an efficient weatherstrip and insect seal, yet is easy to install and maintain. Made of high-strength aluminum extrusions, Skuff Guard is fitted with a vinyl tube for tight pressure-seal full width of door. \$6. Richmar Industries Inc., Dept. PM, 5304 N.W. 35th Ave., Miami, Fla.

for home improvement

in do-it-yourself materials



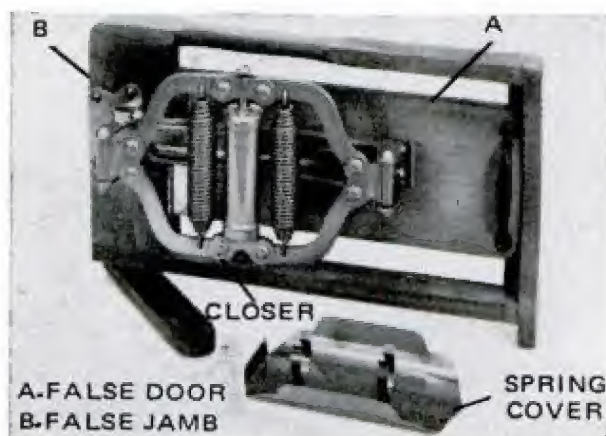
WOODGRAIN MOLDINGS, made of tough Cicolac plastic, closely match paneling. They can be applied with nails, adhesive or staples and will not split, crack or warp. Shapes include inside and outside corners, coves, divider strips and edge moldings, cost about \$1.50 per 8-ft. length. Glass Laboratories Inc., Dept. PM, 863 65th St., Brooklyn, N.Y. 11220.



EPOXY AND VINYL are combined in Poxymix to achieve a curable bonding agent for patching concrete or resurfacing sidewalks. In quart (\$2) and gallon (\$4.99.) sizes, patching material is ready for use after adding water. Surface to be patched needs no prewetting. Paint Master Brush and Roller Co., Dept. PM, 45 West 17th St., New York, N.Y. 10011.

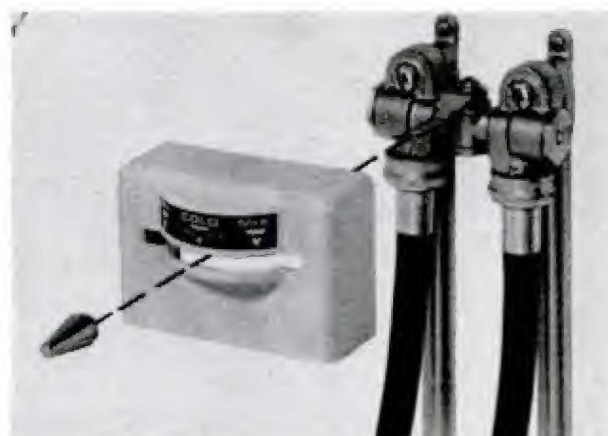


CEILING TILE labeled Chatham by Armstrong Cork Co., Lancaster, Pa. 17604, has no customary edge bevels due to a new blend of natural and man-made fibers. Rich, textured tiles shown were cemented to ceiling and false beams added for coffered (recessed) look. Price: 34 cents per sq. ft. For free illustrated ceiling booklet, write to the maker.

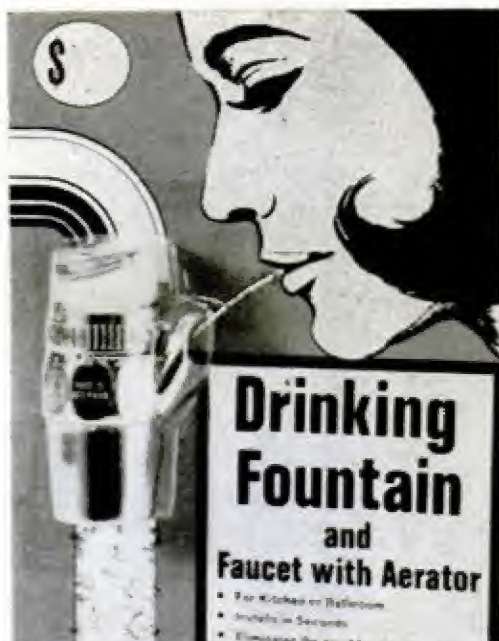


LOWEST PRICED hydraulic door check on the market is the claim made for Kant Slam Door Check. Door opened more than 90° will remain open; a single screw adjusts closing speed. Closer can be installed indoors or out; \$14.95 f.o.b. Kant Slam Door Check Co., Dept. PM-1, Bloomfield, Ind. 47424.

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WASHING-MACHINE VALVE works like a switch, lets you select a cold-water cycle or conventional hot-and-cold mix if your machine doesn't do it automatically. When closed, Cold-Cycle protects the machine, keeps the supply hoses from bursting. \$9. Symmons Industries, 31 Brooks Drive, Braintree, Mass.



DRINKING FOUNTAIN designed to fit most sink faucets eliminates need for germ-collecting drinking glass. It comes ready for immediate installation on internally threaded faucets, can easily be adapted for external threads. Model DF-6001 sells for \$1. Jacklo, Inc., 35 Lafayette Ave., Brooklyn, N.Y. 11217, makes it.



ELECTRICAL CONNECTORS for splicing 18 to 10-ga. wire require pliers only for installation. Called Scotchlok, connectors Nos. 561 (14 to 18 ga.) and 562 (10 to 12 ga.) are available at hardware and discount stores for about 10 cents each. 3M Electro-Products Div., 3M Center, St. Paul, Minn. 55101.

READY-MADE RAILINGS and columns, offered in three patterns in black or white "lifetime" finish, are easily installed. Homeowner can have a custom-designed installation by selecting components from free brochure offered by maker. For brochure and nearest dealer, write Four Seasons Aluminum Railings and Columns, Bel-Met, Inc., Dept. PM, 439 South Maple Ave., Greensburg, Pa. 15601.



KEY-OPERATED ALUMINUM BAR LOCK fits most sliding doors with metal frame and 1 1/4-in. or wider bottom rail. Patio Lock is attached to inside of door with three metal posts that fit drilled holes, is accessible only to person with key. About \$10. Write Patio Lock, Deerfield Lock Co., Dept. PM, 945 Wayne Ave., Deerfield, Ill. 60015.



SELF-STICK CARPET TILE from the Ozite Corp., Libertyville, Ill. 60048, labeled Excello can be picked up for cleaning. High-density rubber back eliminates peeling off paper, messy adhesives and is claimed to cling to any floor. Price, 39 cents per tile.





SAW SLOT lets you slip pilaster over bracket; recess on back hides standard. Slot allows bracket to be placed anywhere along length of the notched standard. Snug fit, plus shelves, holds the pilaster

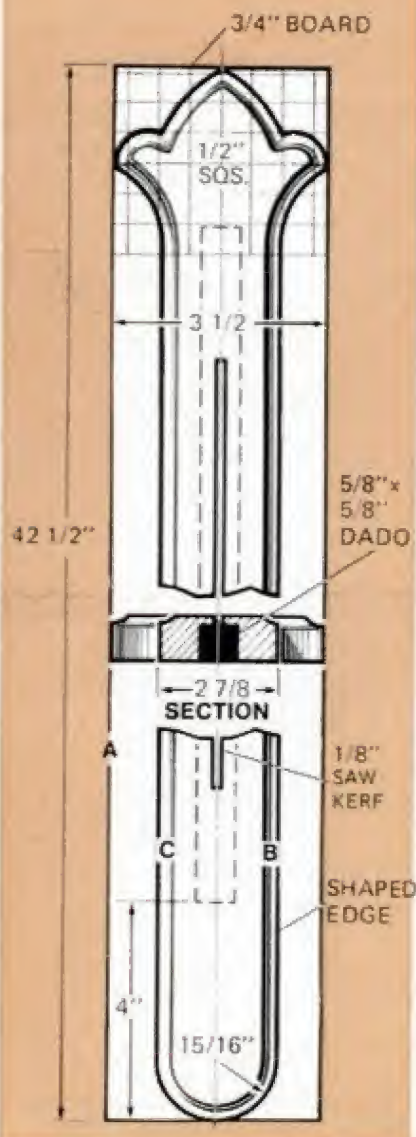


Add eye appeal to shelf brackets

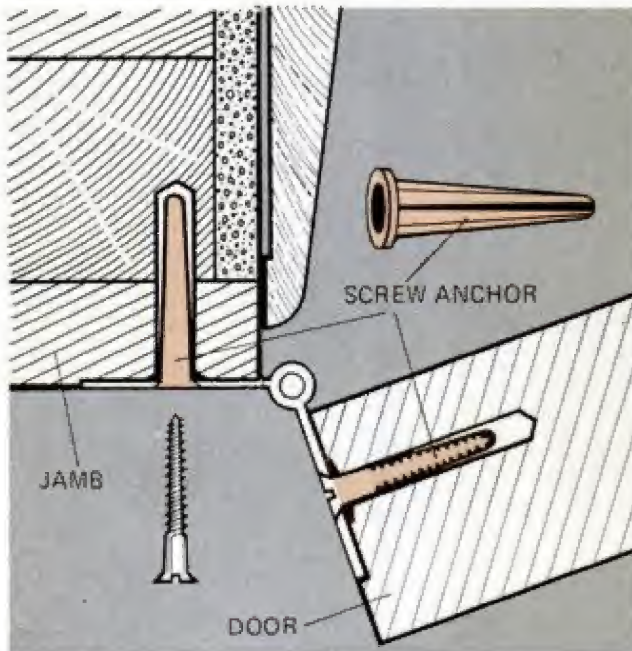
By ROBERT WORTHAM

IF YOU WANT TO TAKE AWAY the unfinished look of plain shelf brackets, cover the notched metal standards with these attractive wood pilasters. They're recessed on the back and slotted down the front to fit over both the brackets and standards after they are screwed to the wall. They're made from 1x4 pine to suit the length and width of the particular standard (a $\frac{5}{8}$ -in.-sq. dado will fit a Knap & Vogt standard perfectly).

Except for the top and bottom, all cutting is done on the table saw. First cut the blind dado down the middle, then center the saw kerf in the dado. Each cut is made with edge (A) always against the saw fence, even when you are ready to saw the final shape. The blind groove is cut by lowering the work down over the dado blade while it's running. The $\frac{1}{8}$ -in. saw kerf is made the same way, starting and stopping the cuts where desired. Remember that the length of the groove has to be greater than the length of the standard. Make rip cut (B), then (C) as far as you can on the table saw and finish the scroll end with your sabre saw. Finally, run a small cove around the edge. Finish the pine with an antiquing kit of the desired shade. If you use ready-made shelves, they'll have to be notched about $\frac{1}{4}$ in. deep at the back to fit around the pilasters. ★★★



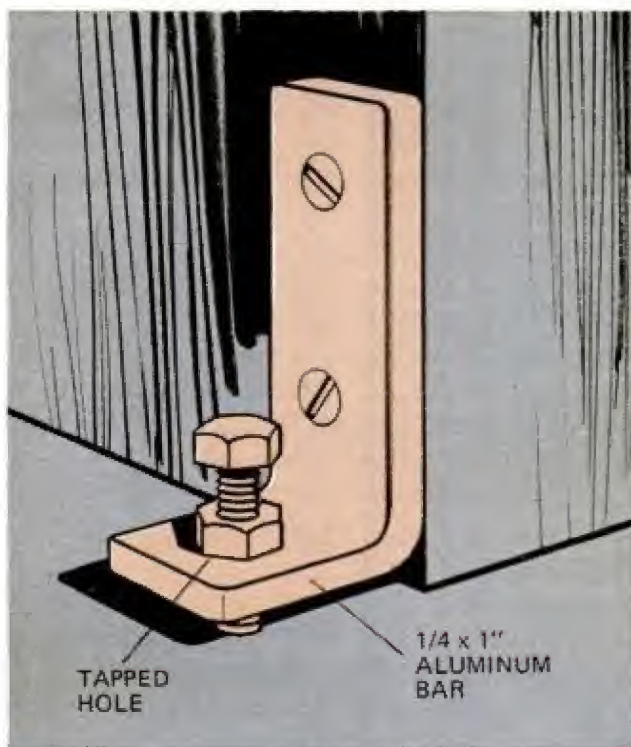
BETTER WAYS TO DO IT!



LOOSE HINGE SCREWS can be tightened quickly by using plastic drywall anchors. Just choose anchors sized to suit the screws and screw holes and drive them in the oversize holes.—Leo Niemi, Warren, Ohio



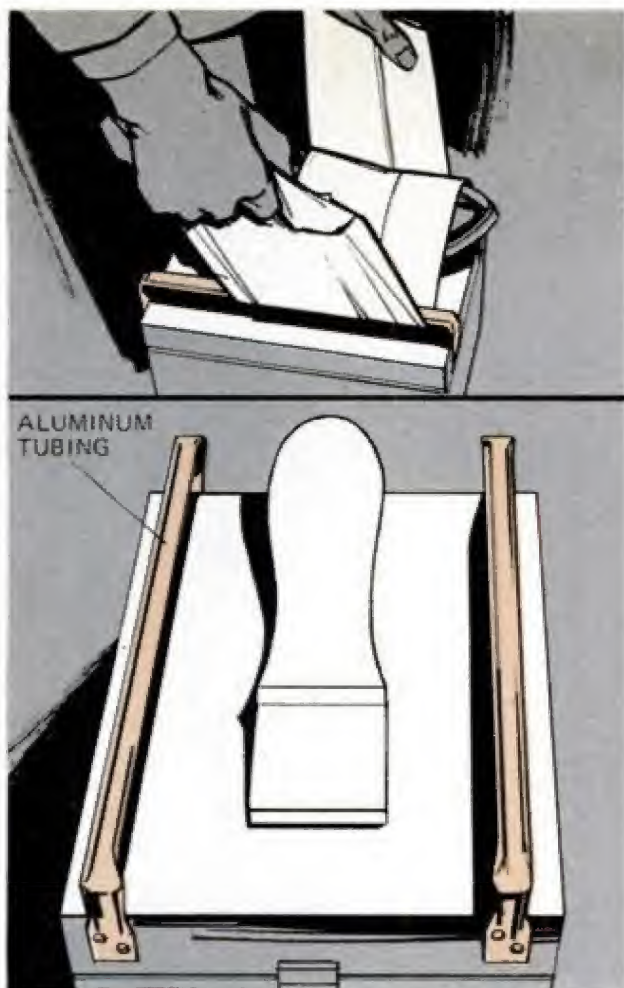
PLANING A DOOR when you have no helper to hold it steady will be a lot easier if you use bar clamps and a block of wood as shown. Then you can hold plane with both hands.—Abe Contreras, Azusa, Calif.



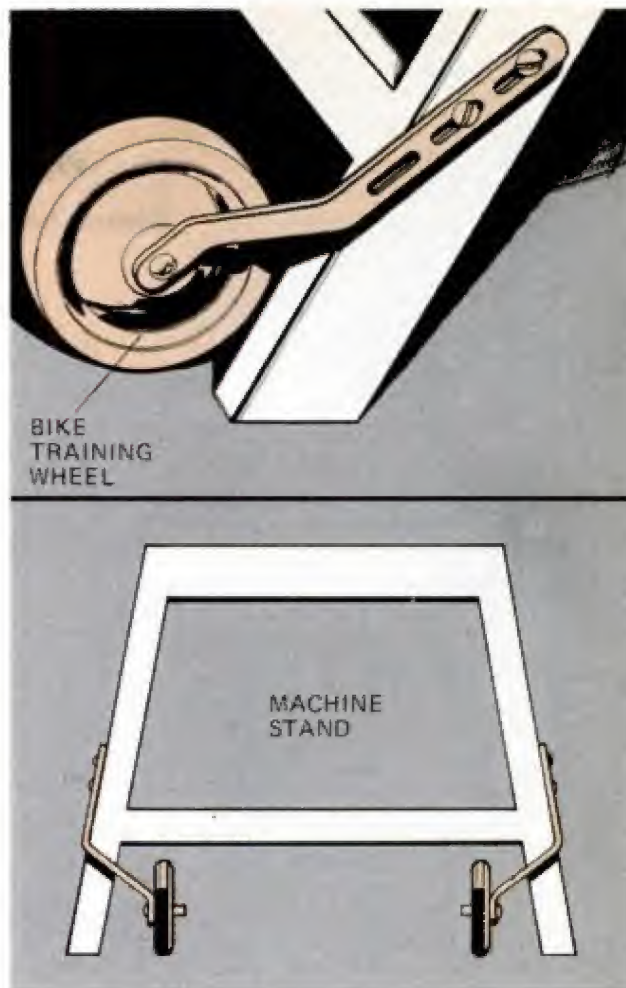
WOBBLE PROBLEM with a bench-saw cabinet or other toolstand can be eliminated with this leveler. Drill and tap one end of an L-shape bar and use a nut and bolt as shown.—Doug Blodgett, St. Charles, Mo.



GETTING AN OPINION as to the right spot to hang a heavy mirror is a less arm-wearying task when you hold up a same-size dummy mirror made of lattice strips and string.—Fred Rittenbusch, Elsinore, Calif.



POLISHING YOUR SHOES will be easier and you'll also get a better shine if you add tubing to each side of the shoeshine box so the cloth can be pulled up instead of down.—George Walker, Nutley, N.J.

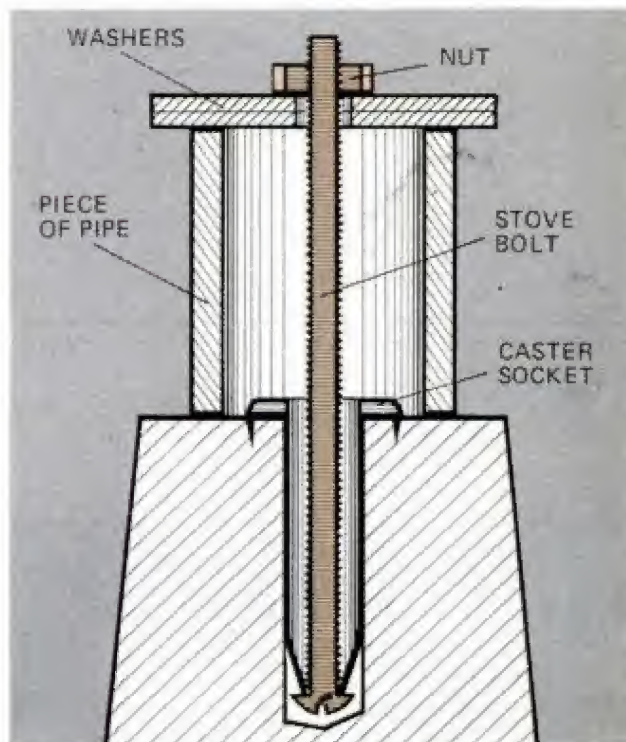


TRAINING WHEELS no longer needed on a kid's bike will make it easy for you to roll a heavy bench saw around your shop when they're bolted to a pair of legs on the machine stand.—P. R. Bliss, Atlanta, Mich.



IMPROVED "FEET" for a trinket box can be mere dabs of hot-melt glue. You apply them at each corner of the base and in 20 seconds you can have nonslip, nonscratch legs.—Joel Amkraut, Palo Alto, Calif.

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STUBBORN CASTER SOCKET can be removed by driving in a stovebolt until its head hooks over top of the socket. Then, using a spacer, turn a nut on bolt to pull it out with socket.—James Forney, Nutley, N.J.

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EXCITING NEW PRODUCTS

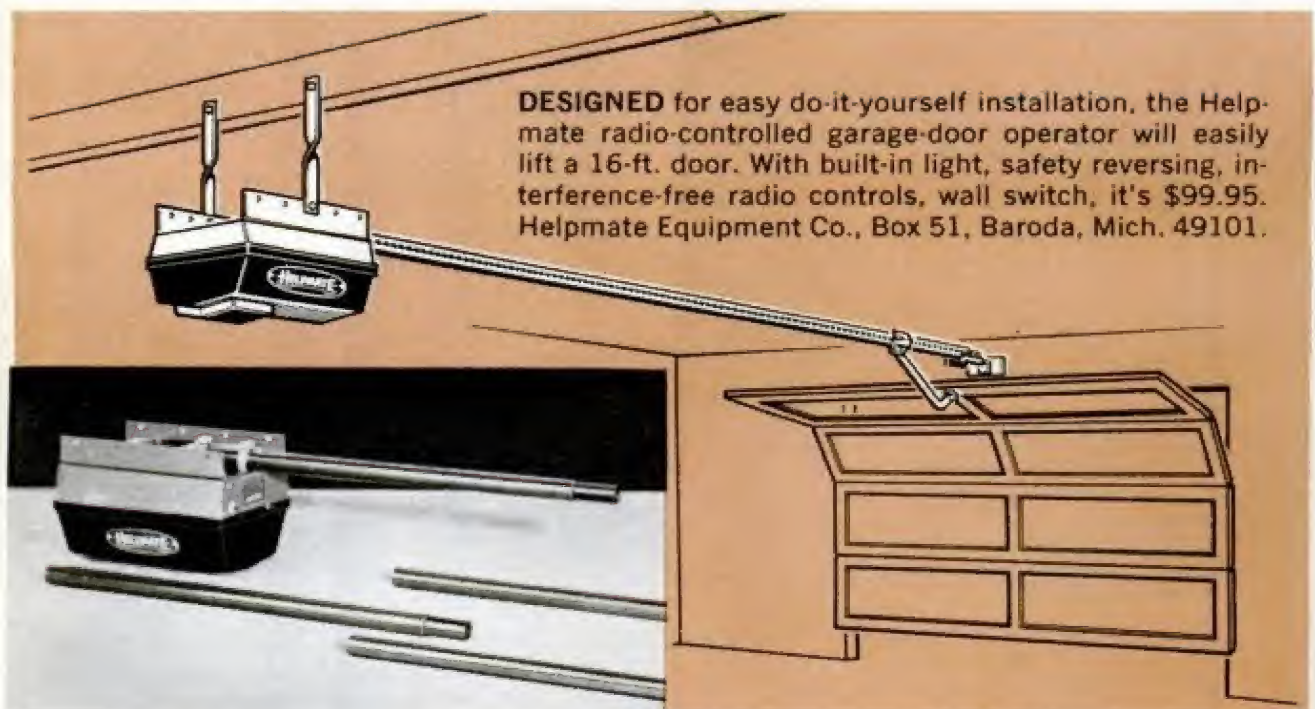
BY CATHERINE BILSKI



CREATE THE LOOK of royal elegance in your bathroom with "Camelot" vanities and wall cabinets. Made of rigid polyurethane, with the look of real hand-rubbed oak, they're strong enough to stand even the roughest treatment. Vanity (without top), \$135; wall cabinet (recessed or surface-mount), about \$70. Sold by Williams Products, Inc., a subsidiary of Leigh Products, Inc., Coopersville, Mich. 49404.



HIDE that unsightly toilet-bowl brush with the Conceal-A-Brush bathroom accessory. This standard-size, recessed paper holder with a hinge on bottom and knob on top becomes a cabinet door to a removable plastic brush container that fits inside any standard 2x4-framed wall. It's priced at \$13.95 from Herman H. Miller & Assoc., Inc., 809 West North Shore Dr., South Bend, Ind. 46617.



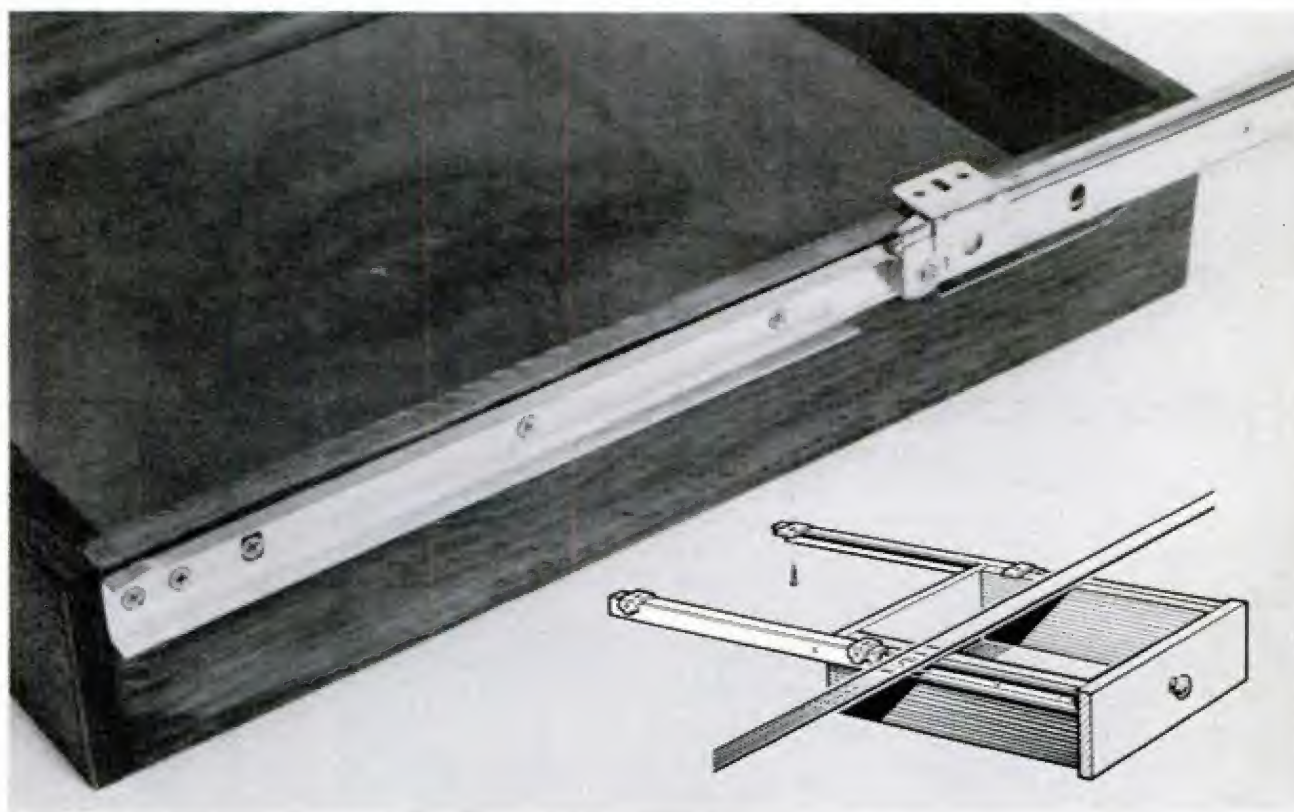
DESIGNED for easy do-it-yourself installation, the Helpmate radio-controlled garage-door operator will easily lift a 16-ft. door. With built-in light, safety reversing, interference-free radio controls, wall switch, it's \$99.95. Helpmate Equipment Co., Box 51, Baroda, Mich. 49101.



ACCENT YOUR WALLS with the authentic look and feel of real stone, mortar and all with Chapel Natural prefinished hardboard textured panels. Early American appearance is ideal for dining room, living or recreation area. The beige-colored simulated stone complements any room decor. A 4x8-foot panel sells for about \$15 from Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606.



MINIMIZE THE RISK of accidents with the Model A Leveler. Easily attached to the sides of a stepladder with three flathead screws and nuts, the levelers can make a ladder stand straight on any surface or grade up to nine inches. Rubber feet are press-fitted for easy replacement. \$9.95 per pair postpaid from Lanier Enterprises, Inc., Box 1076, Cocoa, Fla. 32922.



INCREASE DRAWER SPACE in home, shop or garage without making cabinets. Latest drawer slides offered by Grant Pulley and Hardware Co., High St., West Nyack, N.Y. 10994, let you "hang" a drawer under any flat surface. Available in nine lengths from 12 through 28 in., No. 344 slides have 50-lb. load capacity and are sold through hardware stores.

SHORT COURSE IN WOOD JOINERY

By **WAYNE C. LECKEY**
Home and Shop Editor

WILL THAT TABLE you just completed last a hundred years or more like the fine pieces produced by cabinet-makers of old? Much will depend on how well it was put together—but more importantly, on what joinery was used.

Furniture that relies on mere butt joints will never make it, for wood is known to shrink, be affected by moisture and humidity, and gradually loosen up at the joints as age sets in. Only when the parts are made integral through carefully fitted joints can you expect your cabinetry to “live” to a ripe old age.

As you see here, many different kinds of joints can be used in assembling your workshop furniture. The one you pick depends a great deal on the piece itself. Often you have a choice, one joint being as strong as the other but requiring a special tool to make it. There are dowel joints, mortise-and-tenon joints, lap joints, spline joints, pinned joints, miter joints, rabbet joints, dado joints and lock joints, to name a few. There are special joints to put drawers together, conceal corners and glue tabletops. Each shares a place in making you a master craftsman.

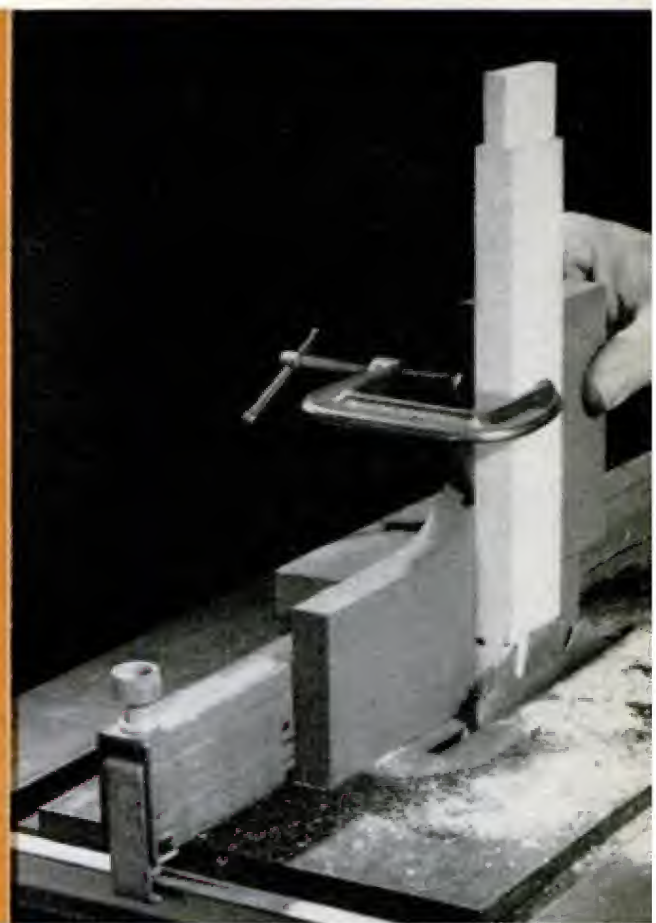
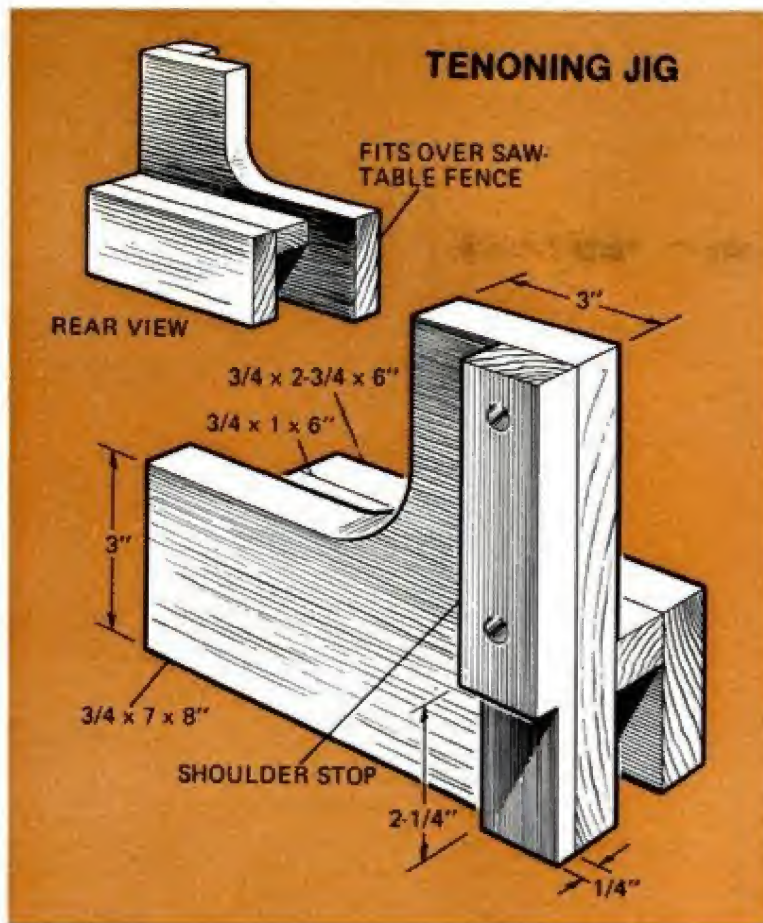
One of the handiest fixtures you can



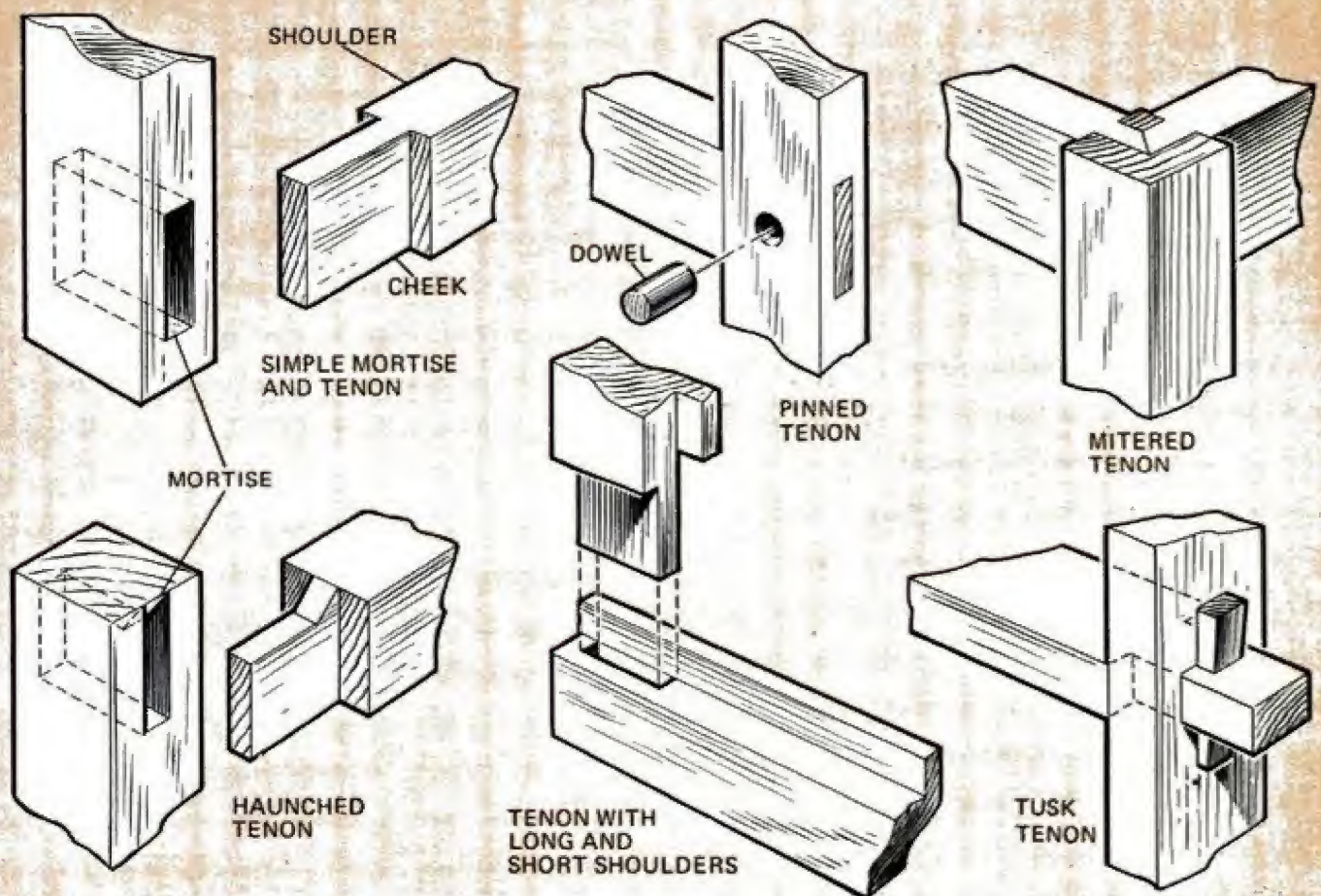
Photos by Robert D. Borst

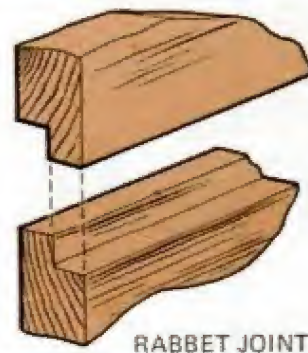
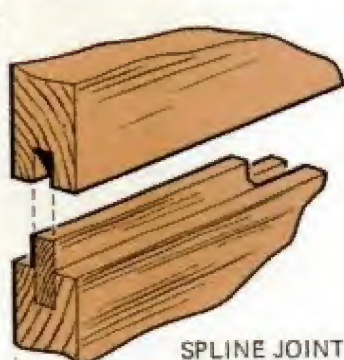
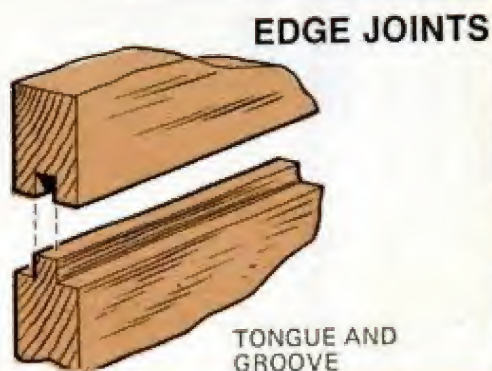
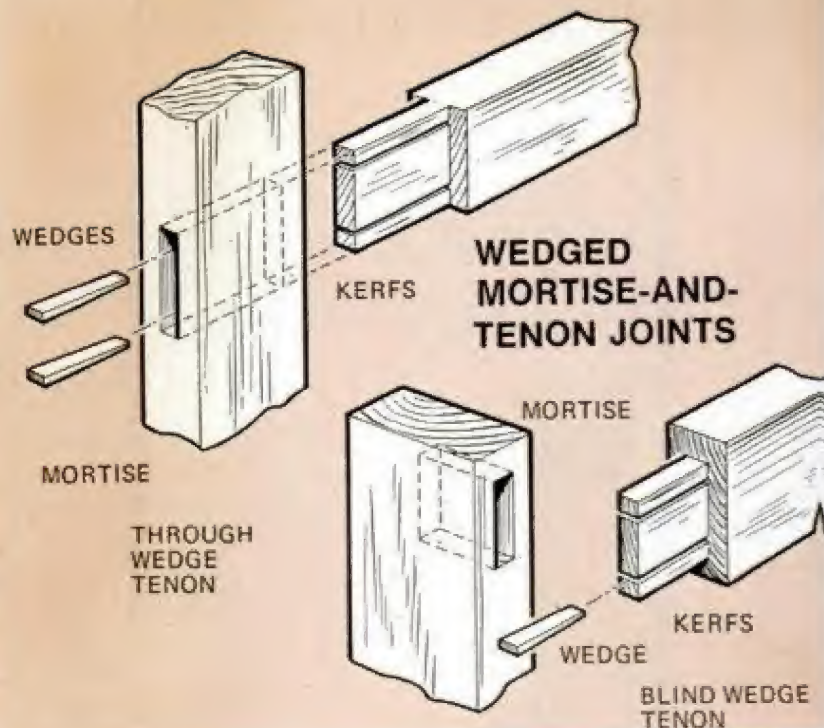
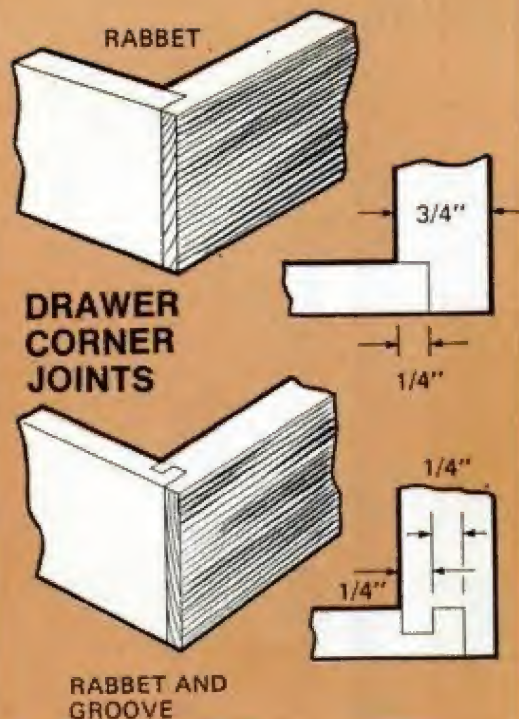


POPULAR MECHANICS

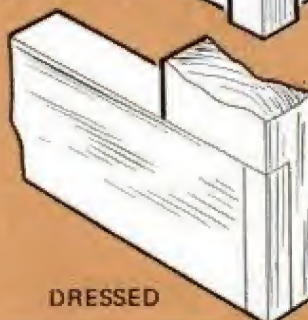
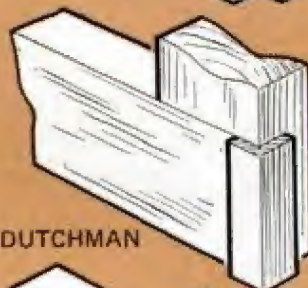
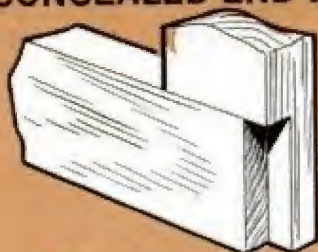


DESIGNED TO STRADDLE SAW FENCE, this homemade tenoning jig lets you cut accurate-fitting tenons safely on narrow stock. Diagrams show how jig is made from scrap wood. In use, work is clamped to jig

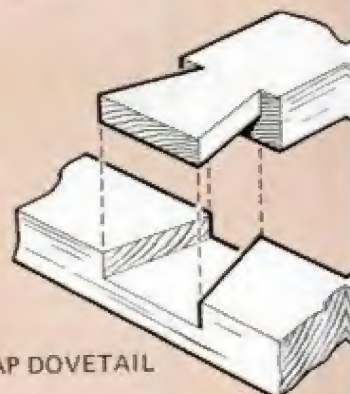
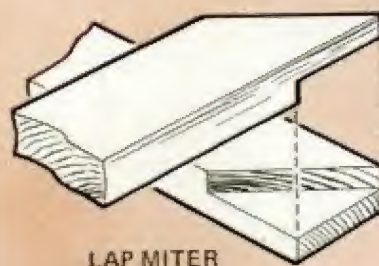
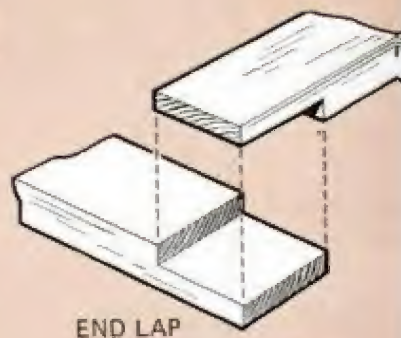
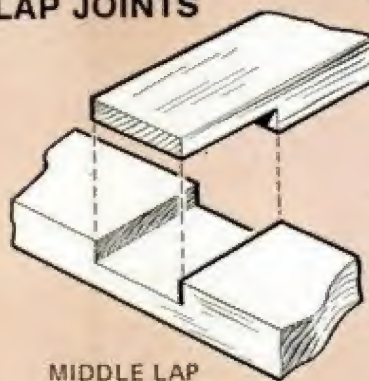




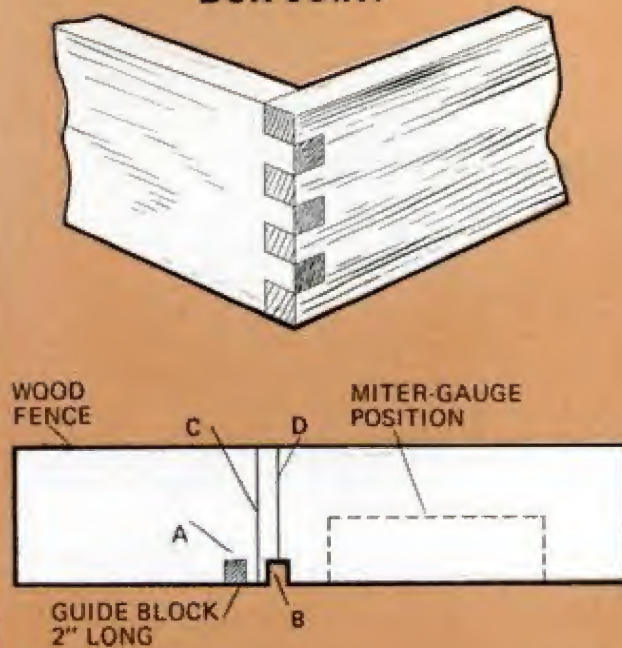
CONCEALED END LAP



LAP JOINTS



BOX JOINT

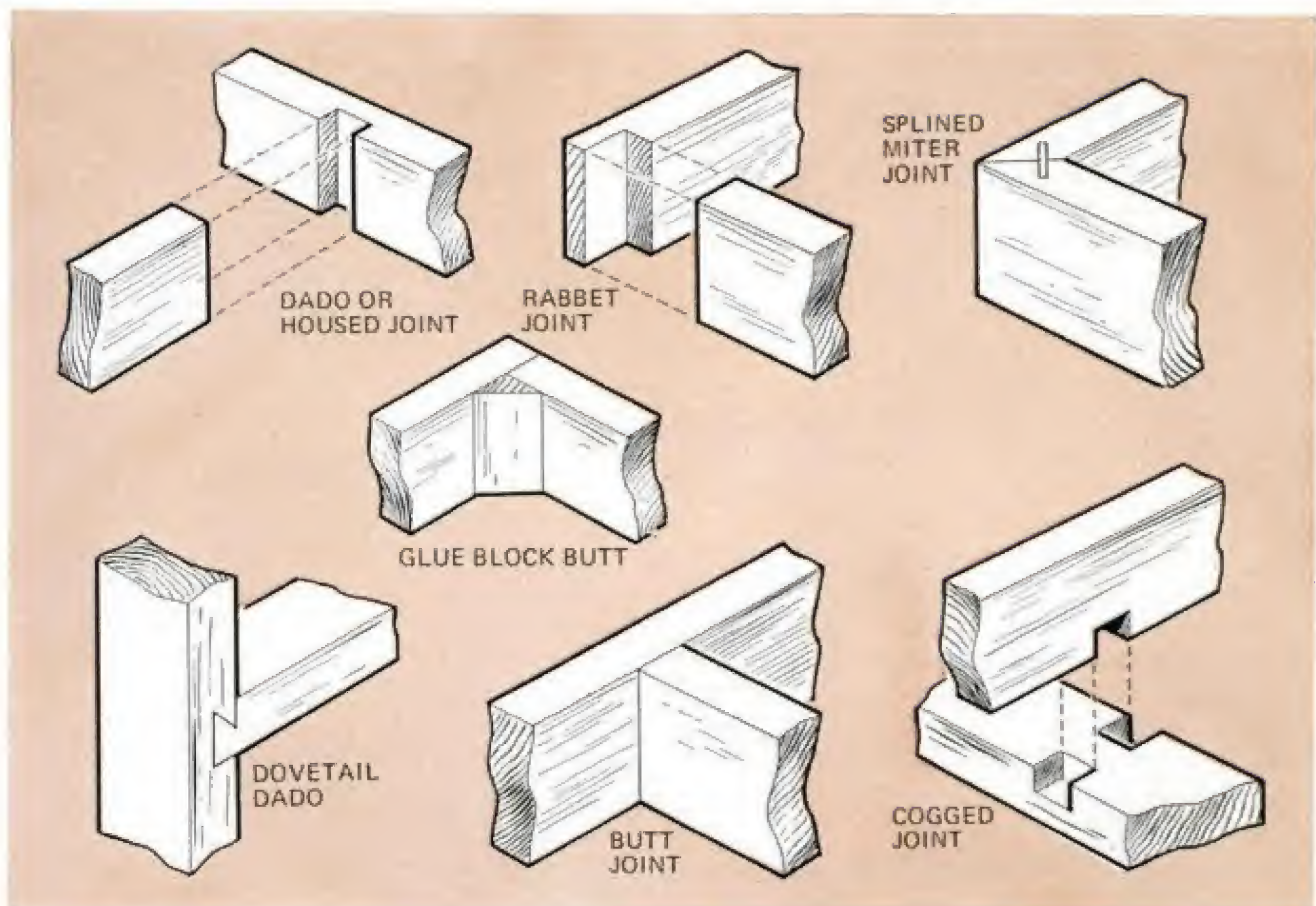


BOX JOINT is made on table saw with dado head. Jig attached to the miter gauge spaces the cuts uniformly

make for cutting tenons on a table saw is a tenoning jig. Detailed at the top of page 157, the jig is designed to straddle and slide along the saw fence so you can make cheek cuts on narrow pieces safely. Work to be tenoned is placed against the shouldered stop on the jig,

clamped and then passed through the saw. Then the work is turned around and the cut is repeated to make the second cheek cut, and finally, the work is turned end for end to cut the opposite tenon. Cheek cuts on a tenon are generally

(Please turn to page 200)





Bed by night, toy by day

By WINSTON S. GOO

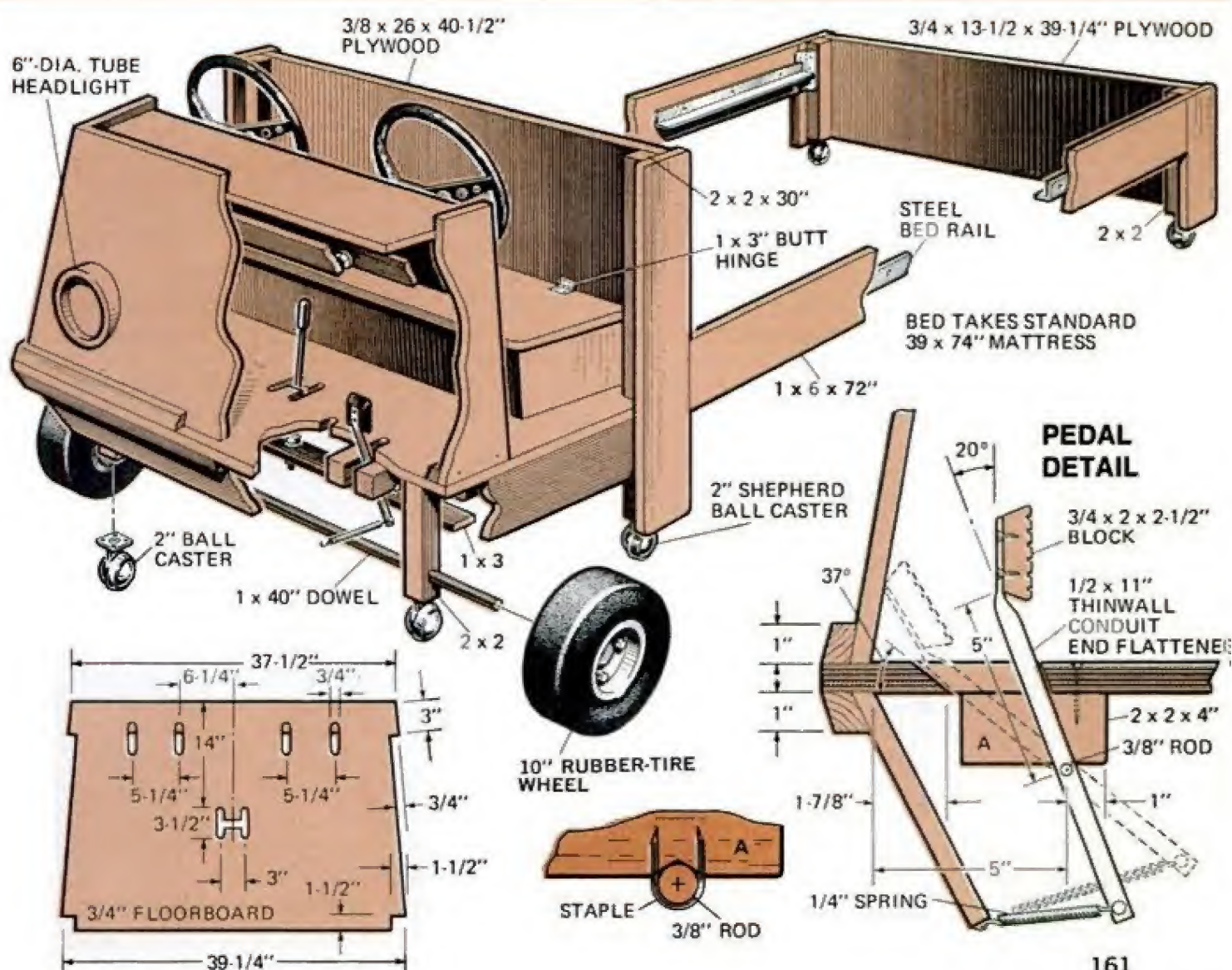
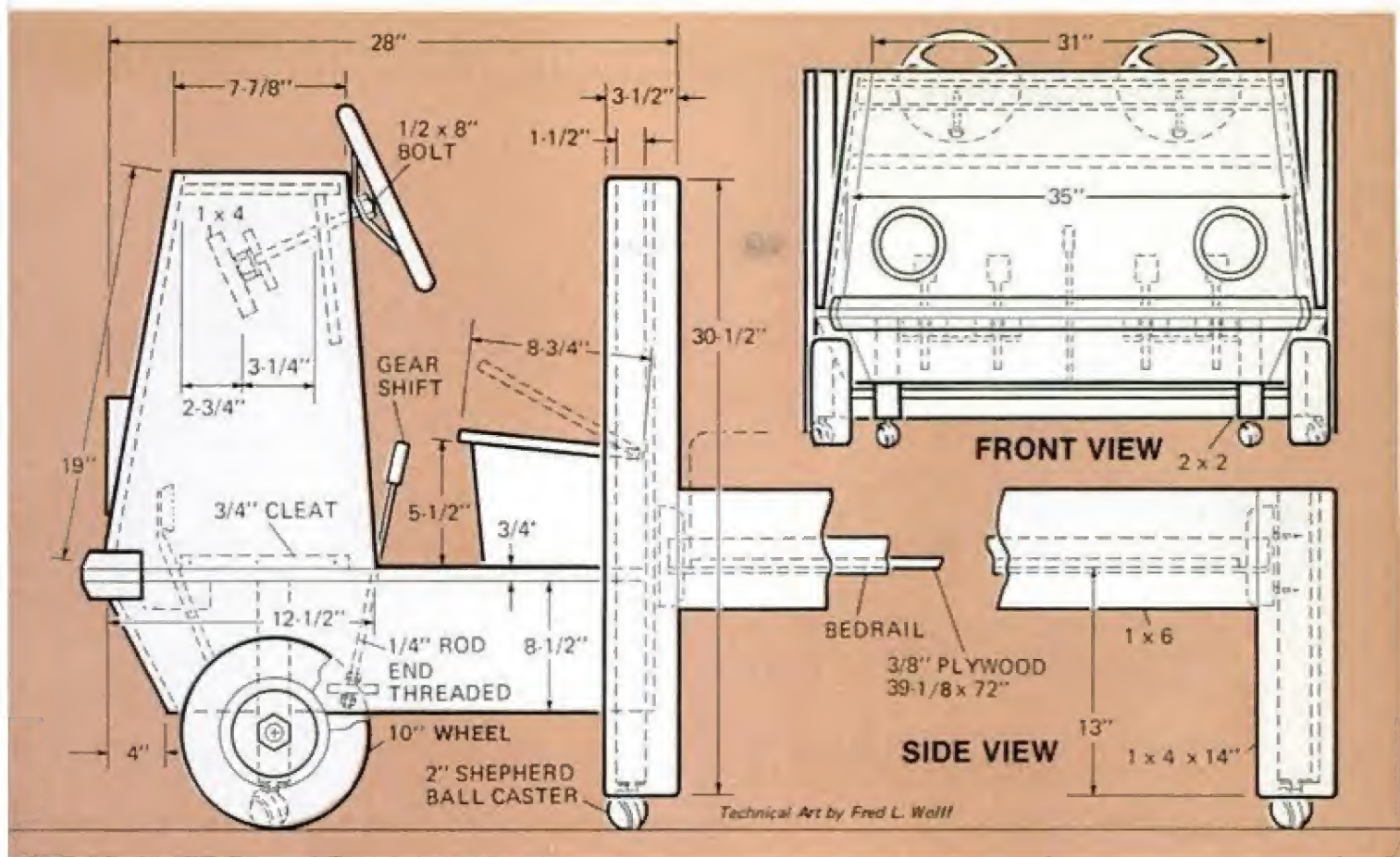
BUILD THIS YOUTH BED and your youngster will be undisputed chief of the neighborhood fire department. Constructed for the most part of $\frac{3}{8}$ -in. plywood, the combination bed/fire truck can easily be made using a bench or radial saw. It provides roomy comfort for undisturbed sleep and the truck is sure to draw the preschool gang to the bedroom on rainy days for hours of fun. I've seen similar beds on the market for over \$200, but this version cost me less than \$40 (not including the mattress).

To build the bed, purchase all the non-wood parts first. Then, should your parts vary from those that I used, dimensional changes can be made. The ideal material for the headlamps is 5-in. plastic electrical conduit. If you can't get a short length of this material, the rings could be cut from cardboard tubing or a large, plastic drain pipe. The two 10-in. wheels support no weight and were bought used at a go-kart shop. With these on hand, you can measure the shaft diameter and

purchase the support dowel. The 10-in. steering wheels can be bought at an auto junkyard for about \$4 apiece.

Cut the floorboard first. Use center lines to locate the $\frac{3}{4}$ -in. slots and the $\frac{3}{8}$ -in. H-shaped slot. The side rails (1x6s) are approximately 6 ft. long. But *check mattress dimensions* before cutting them. Most of the exterior dimensions of the cab section shown are to the outer corners in the event vertical miter cuts are made. The two sides are the reverse of each other, and cannot be cut at the same time. Cut and tack together all vertical pieces first, then measure and cut the horizontal pieces to fit. Angled corners can be fastened on the inside by nailing a $\frac{3}{4}$ -in. cleat shaped at the same time the individual angled piece is cut.

The finished product should be well-sanded and primed before the final non-toxic (leadfree) color is applied. Last, cover the bumper with aluminum trim tape—either with one 3-in. strip or two overlapped 2-in. strips. ★★★



Tricks for troubleshooting your cooling system

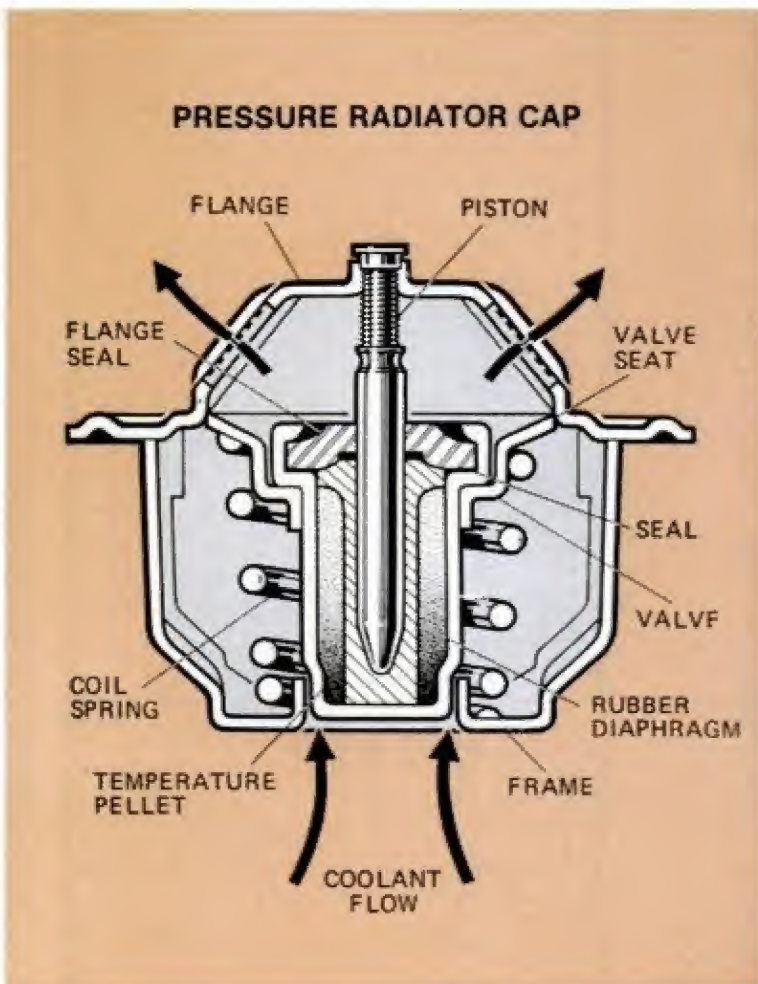
By MORT SCHULTZ

COOLING SYSTEM MAINTENANCE usually prevents trouble. But it's no guarantee that you won't some day have an engine that overcools, overheats or loses coolant.

Take the problem of overcooling—when your temperature gauge doesn't reach operating temperature no matter how far or how hard you drive. If the problem is truly failure of the engine to heat up (and not a faulty temperature-sensing unit or gauge), the heater will blow out cool air. Most serious, though, is the fact that an engine that doesn't operate at optimum temperature won't rid the crankcase of condensation that will mix with oil and form sludge that can eventually gum up internal parts.

Usually, an engine fails to heat up or is slow to heat up because of a faulty thermostat. Thermostats in today's cars contain a temperature-sensitive pellet. As the temperature of the coolant increases, the pellet expands and pushes a piston that opens a valve to allow coolant to flow through the radiator.

When an engine is cold, the pellet is



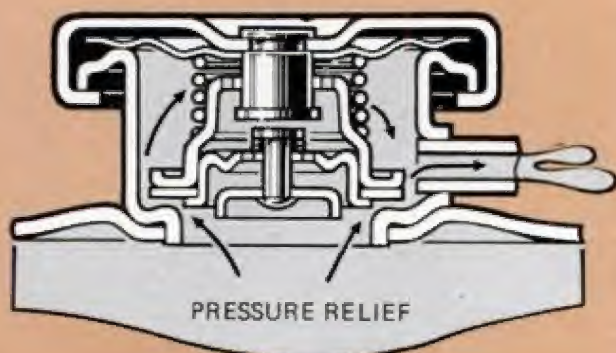
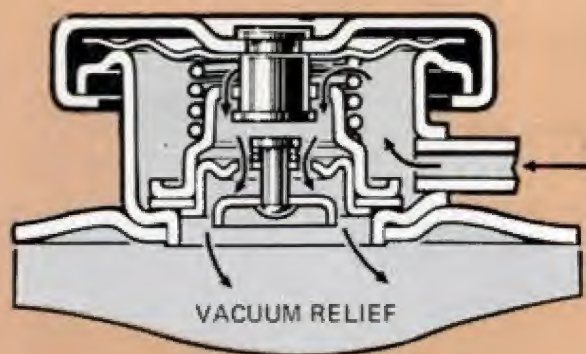
THERMOSTAT regulates temperature. If it sticks open or closed you get overheating or overcooling

constricted. This keeps pressure off the piston and, consequently, off the valve which remains closed. Coolant flows through the engine instead of the radiator, thus allowing it to reach optimum operating temperature, and as quickly as possible. If the thermostat valve is stuck in the open position, coolant will flow through the radiator instead of staying in the engine, and it will stay cool.

How do you determine if your overcooling problem is caused by the thermostat? And, if the problem is a malfunctioning thermostat, what can you do to try and salvage it? First, check the specified rating for the thermostat that should be in your car. Most today are rated at anywhere from 185° to 212° F.

Drive the car for about 10 minutes or let the engine idle for about 20 minutes. Slowly remove the radiator pressure cap. Remove the cap carefully so you don't scald yourself. Cover the cap with a rag and turn it counterclockwise to the first stop—no farther. Don't put any downward pressure on the cap and let pressure which has built up inside the radiator re-

POPULAR MECHANICS



Technical Art by Peter Trojan

PRESSURE RADIATOR CAP is designed to relieve excess pressure and vacuum in your cooling system

lieve itself. This may take several minutes, depending upon how hot the coolant is. When pressure has dissipated, apply downward pressure on the cap and remove it.

Make sure the radiator is filled to the level mark. Place an accurate thermometer in the radiator filler neck so that the bulb is submerged in the coolant. The thermometer should register at least 212° F. Then run the engine at idle in neutral. If the temperature of the coolant stabilizes at 8° to 10° below the rating of the thermostat, the thermostat is okay. For example, if the rating of your thermostat is 190° and the thermometer hits a temperature of at least 180°, there is nothing wrong with the thermostat. The cause of your "overcooling" condition is either a bad temperature-sensing unit or an inaccurate temperature gauge.

On the other hand, if the coolant doesn't get hot enough, don't replace the thermostat just yet. Something may be keeping the thermostat open. To check, cover the face of the radiator with a blanket or cardboard, let the engine idle and watch

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ACCURATE THERMOMETER is essential to cooling-system troubleshooting; cost is approximately \$4



LOWER RADIATOR HOSE may look good, but spring inside it may be collapsing and cause overheating

the thermometer. Allow the coolant to heat up to about 210° F. before shutting off the engine. This will open the thermostat valve fully to flush it.

Now if the engine doesn't heat up to normal operating temperature, you have evidence that the thermostat is shot and should be replaced.

The problem of overheating is much more common than overcooling. In an engine, combustion gas temperatures get as high as 4500° F., and the temperature of lubricated parts, such as pistons, can get as high as 200° above the boiling point of water. If any part of a cooling system lets down on the job, allowing the temperature of the system to exceed safe limits, the engine's valves can begin to warp and burn and pistons can score and burn.

Coolant in a modern automobile would start to boil at too low a temperature if the cooling system were not pressurized. The most important part contributing to pressurization is the radiator filler cap. The boiling point of a solution of ethylene glycol to guard an engine against freezing at minus 20° F. is 224° F. Put under pres-



FAN-BELT TENSION GAUGE sets tension to spec as it must be on engine with many power accessories

sure of a 15-pound pressure cap, that boiling point is increased to approximately 262° F.

The pressure cap itself contains a blow-off (pressure) valve and a vacuum (atmospheric) valve. The pressure valve protects the radiator by relieving pressure if it exceeds that for which the radiator is designed. The vacuum valve opens to relieve the vacuum created as the system cools off.

A radiator pressure cap can lose its ability to hold pressure; that's when overheating can occur. One way to check a cap is to hold it in your hand upside down and look "through" it. If you see any light between the vent valve and rubber gasket, replace the cap. If the rubber gasket is deteriorated or swollen, replace the cap. Make sure the vent valve hangs free. If not, replace the cap.

The most accurate way of testing a radiator pressure cap is with a pressure tester. If you have one (cost is about \$15) or if you can borrow one, wash the cap in clean water and attach it to the tester. Pump up the tester to the rated capacity of the cap. If the meter of the tester falls off more than two pounds under the rating of the cap, replace the cap.

Overheating can also be caused by a lower radiator hose that looks good but is malfunctioning. Inside is a reinforcing spring that keeps the hose from collapsing from suction at medium and high engine speeds. If the spring is deformed or weak and the hose collapses, coolant circulation is cut off, and the engine overheats. If your engine doesn't overheat at idle or slow speed, but does on a fast run, try replacing the hose.



AIR OR GAS LEAKS in the cooling system can be detected very simply (see procedure given in text)

Another tough one is a part that some manufacturers call a distributor vacuum-control switch and others call a temperature-operated vacuum bypass valve. Not every car has one. The distributor vacuum-control switch, temperature-operated vacuum-bypass valve or thermo-vacuum valve—whatever the manufacturer chooses to call it—is normally screwed into the front of the cylinder block. The switch consists of a manifold vacuum port, a carburetor vacuum port and a distributor vacuum advance port.

When engine coolant temperature reaches the boiling point during periods of prolonged idle in particular, a valve plunger in the switch is energized to allow both the manifold and carburetor vacuum ports to open, putting more "pull" on the distributor vacuum advance unit through the switch's distributor vacuum advance port. This allows an increase in engine speed by some 100 rpm to speed up the flow of coolant from the water pump and the speed of the fan, thus helping to cool things down. If the plunger is not operating to open the ports, replace the unit.

Fan drive has become increasingly important especially in airconditioned cars with heavy-duty cooling systems. The fan drive has a thermostatically controlled clutch with the assembly attached to the water pump.

When the full operation of the fan is not needed for cooling, such as when the airconditioner is shut off, the clutch is disengaged and fan speed is limited to a relatively low rpm (about 1200).

When the operating temperature rises, it is sensed by a bimetal temperature

coil. The coil tightens and moves a valve to open a port, permitting flow of silicone oil into the clutch chamber that engages the clutch to turn the fan at a greater speed (about 2500 rpm). This keeps the temperature of the engine within safe limits.

Fan clutches should be replaced for one of the following reasons:

1. *Noise.* If the clutch assembly locks up, there will be a good deal of noise. Try to rotate the fan by hand. If it binds or there is a rough grating feeling, replace the drive.

2. *Fluid leak.* If silicone oil is leaking from around the fan clutch bearing, replace the unit.

3. *Engine overheats or there is insufficient airconditioning cooling.* To determine if the fan drive is at fault, start with a cool engine, which will mean that the fan drive will be disengaged. Cover the radiator to induce high engine temperature, start the engine, turn on the air-conditioner and operate the engine at fast idle.

You should notice a roar from the fan area when the clutch engages, which will take about 5 to 10 minutes after starting the engine. However, be sure to keep your eye on the temperature gauge or warning light. If it should reach the area of over-

heating, remove the cover from the radiator.

You can hear the fan roar most distinctly from in front of the radiator. As soon as the clutch engages, remove the cover from the radiator and shut off the airconditioner. After several minutes in which the engine will cool down, the fan clutch should disengage. If the fan drive fails to operate in this manner, there is a malfunction and the fan drive should be replaced.

Fan belt tension is very important. A loose fan belt will cause slippage and overheating. Using a belt tension gauge is advisable especially when an engine drives many power accessories. The gauge is hooked to the belt so that when the knob is pushed down the tang that is hooked to the belt causes the dial to move. With maximum hand pressure applied to the knob, the dial reads the tension of the belt. Price of a gauge varies from \$14 to \$20.

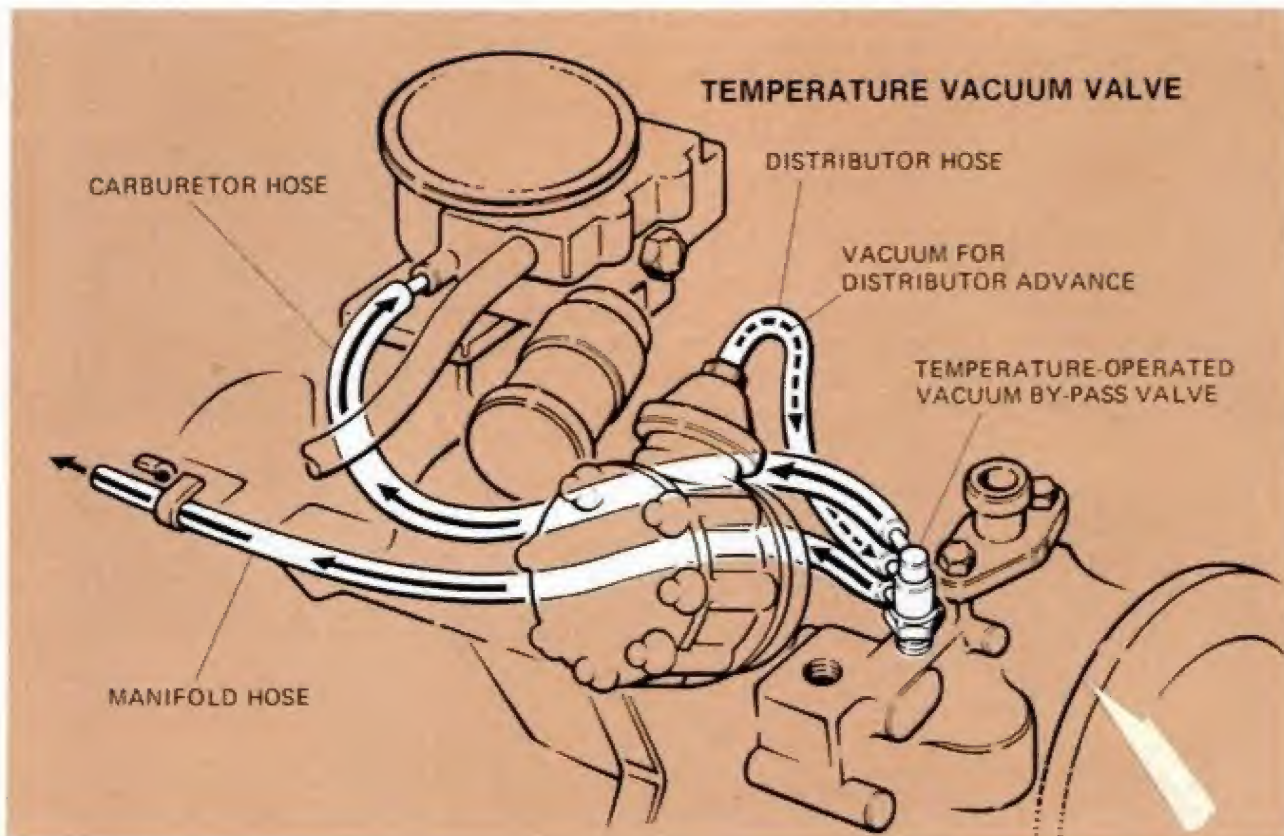
Further cooling-system tips:

- Keep the radiator core clean; blow out with compressed air.

- Coolant can boil if the radiator cap isn't tightened all the way, and it can do so without the temperature warning light coming on. In an Oldsmobile, for ex-

(Please turn to page 199)

AUTOMATIC RPM INCREASE for cooling by boosting vacuum advance at distributor is function of valve



NEW FOR YOUR CAR



LAND ANCHOR helps pull you out of sand and other ground where there are no trees to hitch a rope to. Shaped like a plow, Pull-Pal attaches to any winch-equipped jeep or camper for off-road driving on rugged terrain. Lever action causes hook to embed itself more deeply the harder the pull. Folds to jack size for storage; about \$40. Reliable Tool & Engineering, 308 East Franklin, El Segundo, Calif. 90245.



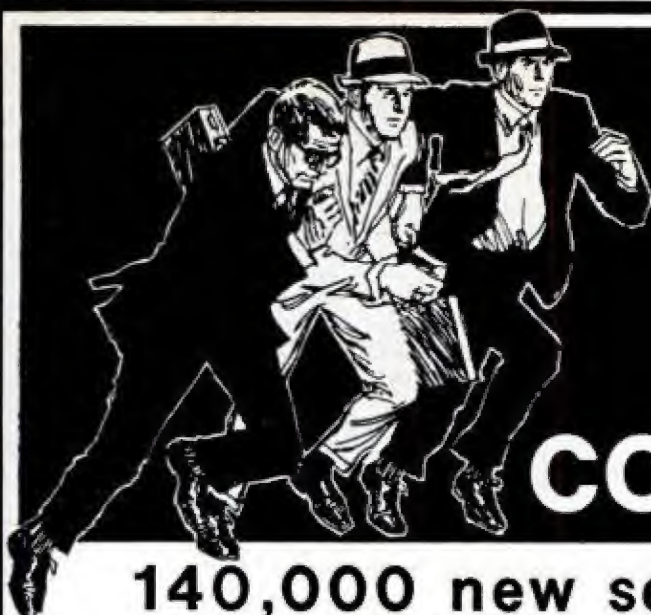
NEW DRY-CHARGED BATTERY at left is activated by plain water instead of dangerous sulphuric acid and needs no pre-charging for use. This means motorists, campers and boaters can keep a spare battery on hand and charge it themselves to avoid being stranded. Built-in acid in dry form heats up when water is added, prewarming battery for instant use. Called Oasis, Prestolite makes it.

ADD-ON HOIST at right can be mounted in a car trunk, station wagon, pickup truck or delivery van to lift heavy objects, such as an outboard engine, into the vehicle. It has a capacity of 200 pounds, can be folded for storage, is \$89.95. Mechanical Specialty Co., 42 1st St., S.E., New Brighton, Mich. 55112.



HANDY PLUG-IN VOLTMETER fits in your dashboard's cigaret-lighter socket and gives you a quick check on battery conditions. It performs three tests: battery strength under no load, battery strength under full load and charging rate while running. Its upward-slanting dial makes it easy to read even while driving. Price is \$6.98 from Automark Industries, Inc., 641 Vermont, Palatine, Ill. 60067. A similar device not shown, called Volt-I-Cator, is made by Accurate Products Co., 2334 Production Drive, Indianapolis, Ind. 46241.





are you headed for
a time-clock number?

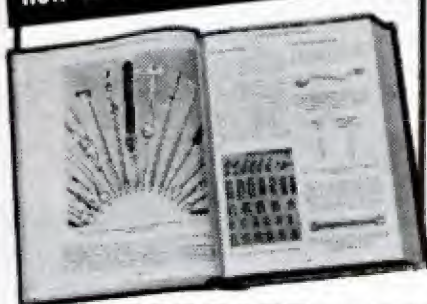
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The Honda Trail 90.

New plug-in TV parts

Almost as simple as changing tubes

By SHELDON M. GALLAGER

REMEMBER BACK in the good old days when you pulled the tubes from a balky television set, checked them down at the local hardware-store tester and came home with a brand-new replacement you could put in yourself? Often you were back in business in half an hour and for only a few bucks.

Then came solid-state circuitry. While it has done much to improve TV quality, it has not made life easier for servicemen. Even a professional repairman winces when you bring in a sick solid-state color TV unless he's a factory-trained expert familiar with your particular make and model.

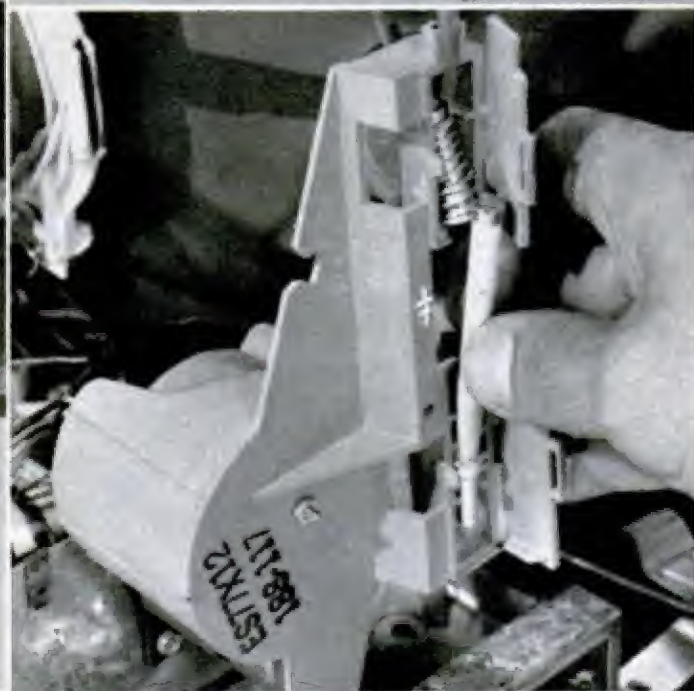
Now the picture is changing. TV makers, aware of the headaches repairmen face trying to unravel the intricacies of advanced

BOTH COLOR AND BLACK-AND-WHITE SETS are going in for plug-in parts. This new 19-inch GE monochrome model has three basic subassemblies that slide out at rear. From left to right in lower foreground are power supply, signal board and sweep board. At top of page is tiny IC audio module, held in clips, that can be slipped out, discarded and replaced as easily as old-fashioned tube

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QUICK, EASY SERVICING is object of newly designed GE sets like one shown here and on page 169. Photo at left, above, shows how parts attach with slip-together connectors that unplug for fast removal. At upper right, tuner cover swings off for

instant access to contacts for cleaning. At lower right, replaceable high-voltage rectifier simply snaps into plastic holder—like changing a cartridge fuse in your home or car. The Model TR465UWD 19-inch monochrome GE table set sells for about \$160

solid-state electronics, are simplifying the job with special easy-to-service circuit parts. These consist of small printed-circuit boards in modular form that can be individually removed and replaced without cutting and soldering wires or fumbling around in hard-to-reach places. The modules plug in like tubes, are almost as easy to change, and are cheap enough to discard like a burned-out tube. All a serviceman has to do is identify the faulty part, slip it out, chuck it away and put in a new one. An entire amplifier stage, power supply or sweep circuit can, for instance, be removed and replaced as a single unit. Repairmen can stock such parts in assorted types and have them on hand for ready use—just like a supply of tubes.

While this won't necessarily bring back the old hardware-store tester, it will mean real benefits for TV owners. With faster, easier servicing, you'll get your set back sooner and with lower labor charges. Motorola pioneered the idea with its "works-in-a-drawer" Quasar line. The entire chassis slides out like a drawer for easy accessibility and contains many plug-in parts. Now other makers are following suit with quickly changed modular parts. GE's newest black-and-white set, its 19-inch Model TR465UWD, plugs simple serviceability as one of its main selling points. Power supply, signal board, sweep board and audio stage are all removable modules. GE's new color sets will also incorporate similar easy-fix features.

RCA, too, has announced a new XL-

POPULAR MECHANICS



Today, a man needs a good reason to walk a mile.

Start walking.



25 mg. "tar," 1.5 mg. nicotine
av. per cigarette, FTC Report AUG. '71.

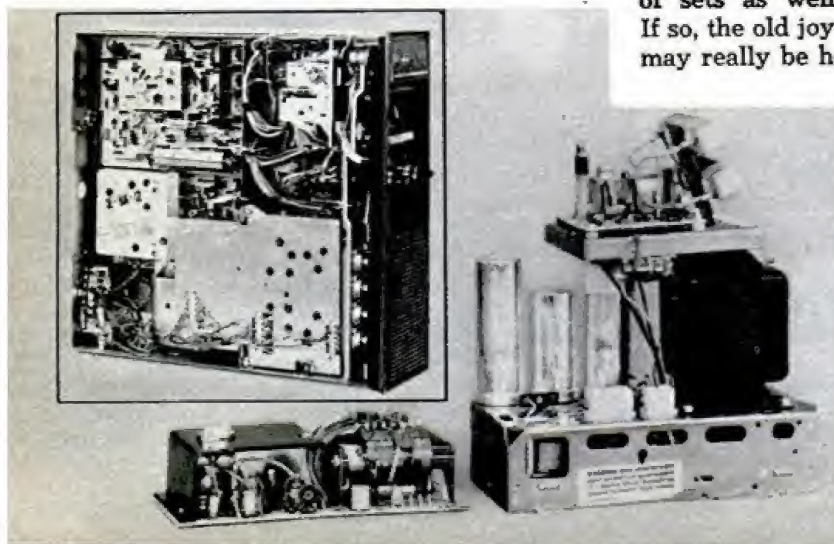


NEWEST RCA COLOR CHASSIS (left, above) contains 12 plug-in circuit modules that can be pulled out and replaced like tubes for fast servicing. Above, tiny ceramic modules are inspected at factory, can be stocked by local TV repairmen for ready use. The new XL-100 AccuColor chassis is available in a series of table and console models for about \$550 to \$1000



HEATHKIT'S FIRST ALL-SOLID-STATE color TV consists mainly of interchangeable circuit boards, plus hinged swing-out chassis for easy access. Company will repair or replace any module for nominal fee—you just slip it out and send it back to factory. Kit sells for about \$580 less cabinet, can be flush-mounted in a wall or in a choice of console styles

100 color chassis that contains 12 plug-in modules and will be used in many of its latest models. Because chassis and modules remain the same for a wide variety of set types, it means a serviceman can stock relatively few replacements and still be able to handle many different models. This helps to keep inventory costs down and can, in turn, be passed on to set owners in lower service costs. Eventually, manufacturers may be able to standardize on basic modular parts that can be used interchangeably in different makes of sets as well as in different models. If so, the old joyous days of tube-changing may really be here again. ★★★



MOTOROLA'S "works-in-a-drawer" chassis (top left) slides out of color sets for easy accessibility and servicing. Many parts on the chassis are plug-in "mini-circuits" for quick removal and replacement. Two lower components show comparison between larger, heavier old-type power supply (near left) and compact new module (far left). Priced from about \$500 for table models to \$775 for the top consoles

POPULAR MECHANICS

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Largest of any van built in the U.S.

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Largest optional V8 (360 cu.-in.).

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Easier entrance and exit for driver and passenger.

Independent Front Suspension

Smooth, independent front suspension can be easily aligned on passenger-car equipment, if necessary.

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Heater is located under hood instead of under dash to give you ample legroom.

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Front passenger seat does not intrude into side cargo door entrance. Side doors are widest of any domestic van.

Fuel Capacity

Largest gas tank of any domestic van (26 gallons).

Turning Circle

Tightest turning circle of any domestic van, yet has the longest wheelbase for smoother ride and handling. Easy to park.

Service Repairs

Large hood opening for outside servicing.

Plus More

The Dodge Strong Box has many more fine features which this space does not permit us to list. See your Dodge Truck Dealer. He'll be happy to show them to you.



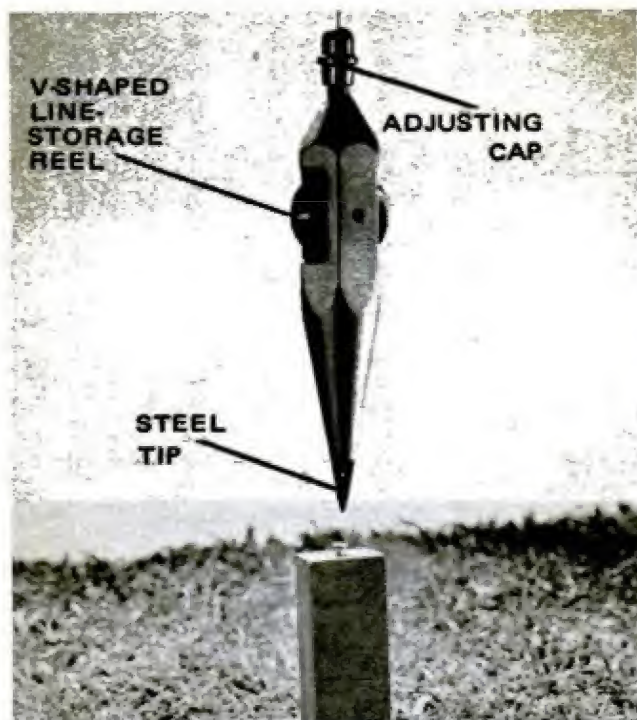
Dodge Strong Boxes are available in 109-inch-wheelbase, 127-inch-wheelbase, and 127-inch-wheelbase Maxivan versions.

Who gives you toughness that's just your style?

Dodge. Depend on it.



New tools for home improvement



PLUMB BOB has a spool in its body for winding line to eliminate spinning when bob is dropped; adjustable cap holds bob where wanted. \$12.50 postpaid. Sensational Plumb Co., 317 Sepulveda St., San Pedro, Calif.

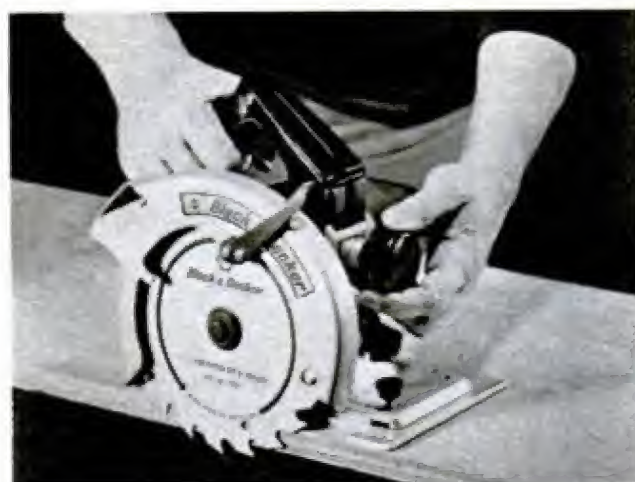


SCREW STARTER marks, starts and threads hole the screw will enter. With hardwood handle, tool fits neatly in nail apron for on-the-job use. At hardware stores, 79 cents. Irwin Auger Bit Co., Wilmington, Ohio 45177.

HANDY-CLAW nail remover, dubbed "cat's paw" by professionals, gets under embedded nailhead for its easy removal. Model HC-10, \$2.30, has molded-on vinyl grip, is made by Estwing Mfg. Co., Rockford, Ill., 61101.



PROFILE SCRAPER from Coastal Abrasive and Tool Co., Inc., Box 337, Trumbull, Conn. 06611, lets you quickly remove paint from irregular surfaces such as molding and chair legs. With seven blades, No. 4725 is \$2.90.



ALUMINUM SHOE that adjusts vertically has been added to Black & Decker's three heavy-duty circular saws. Available in 6½, 7¼ and 8-in. models priced at \$70, \$80 and \$90, respectively, all operate at 5500 rpm.



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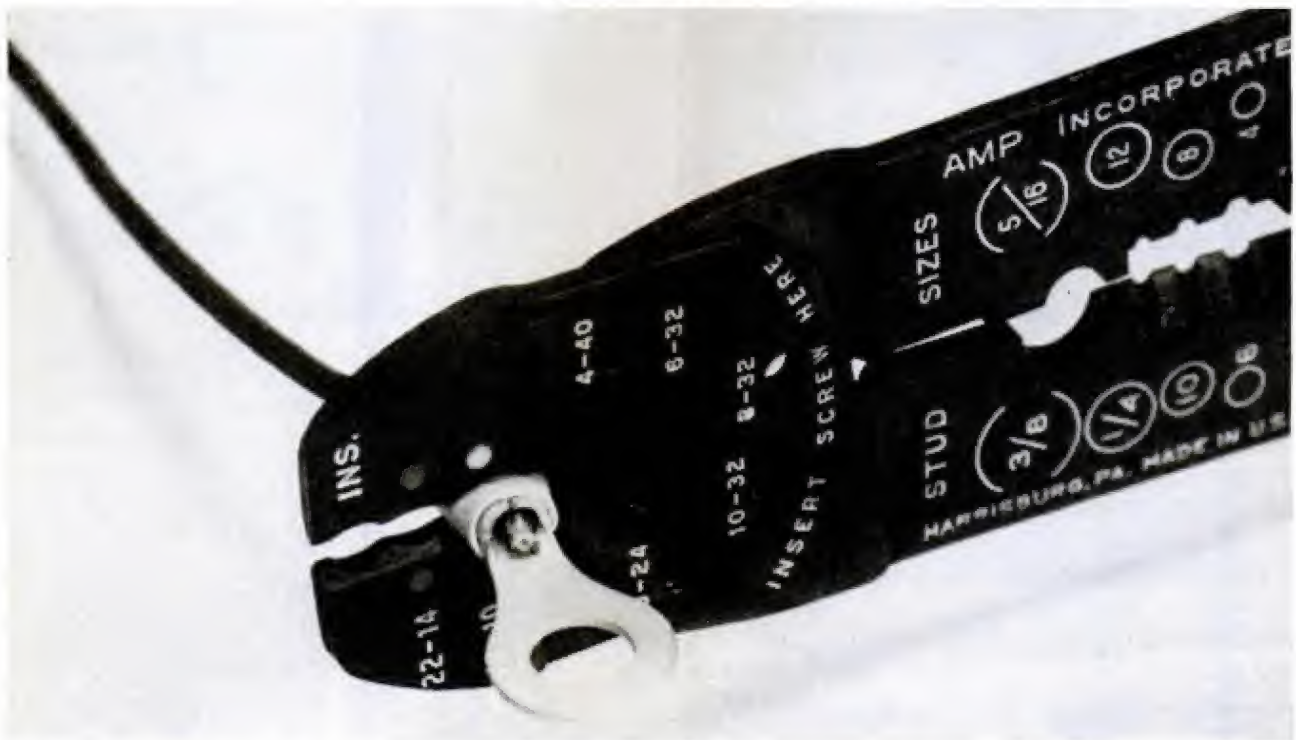
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Crimp-on connectors:

The quick way to make solderless joints

By SHELDON M. GALLAGER/Photos by Robert D. Borst



A QUICK SQUEEZE and you've permanently fastened an eye-type connector to a wire end without any

soldering. This Api tool has an extra-large crimping notch (near center) for auto-ignition cables

THE FASTEST WAY to join two wires or attach a connector is with a crimping tool. If you don't believe it, try one of these handy, inexpensive aids the next time you install a light fixture or hook up speaker leads to your hi-fi set. Widely used by professional installers and repairmen, crimp-on connectors are sometimes overlooked by do-it-yourselfers who figure there may be some special skill required. Actually, nothing could be simpler. You just slip the desired connector on the

bare end of a wire and squeeze the crimping tool around it. The tool's jaws pinch the connector onto the wire, producing a strong and durable locked-in joint.

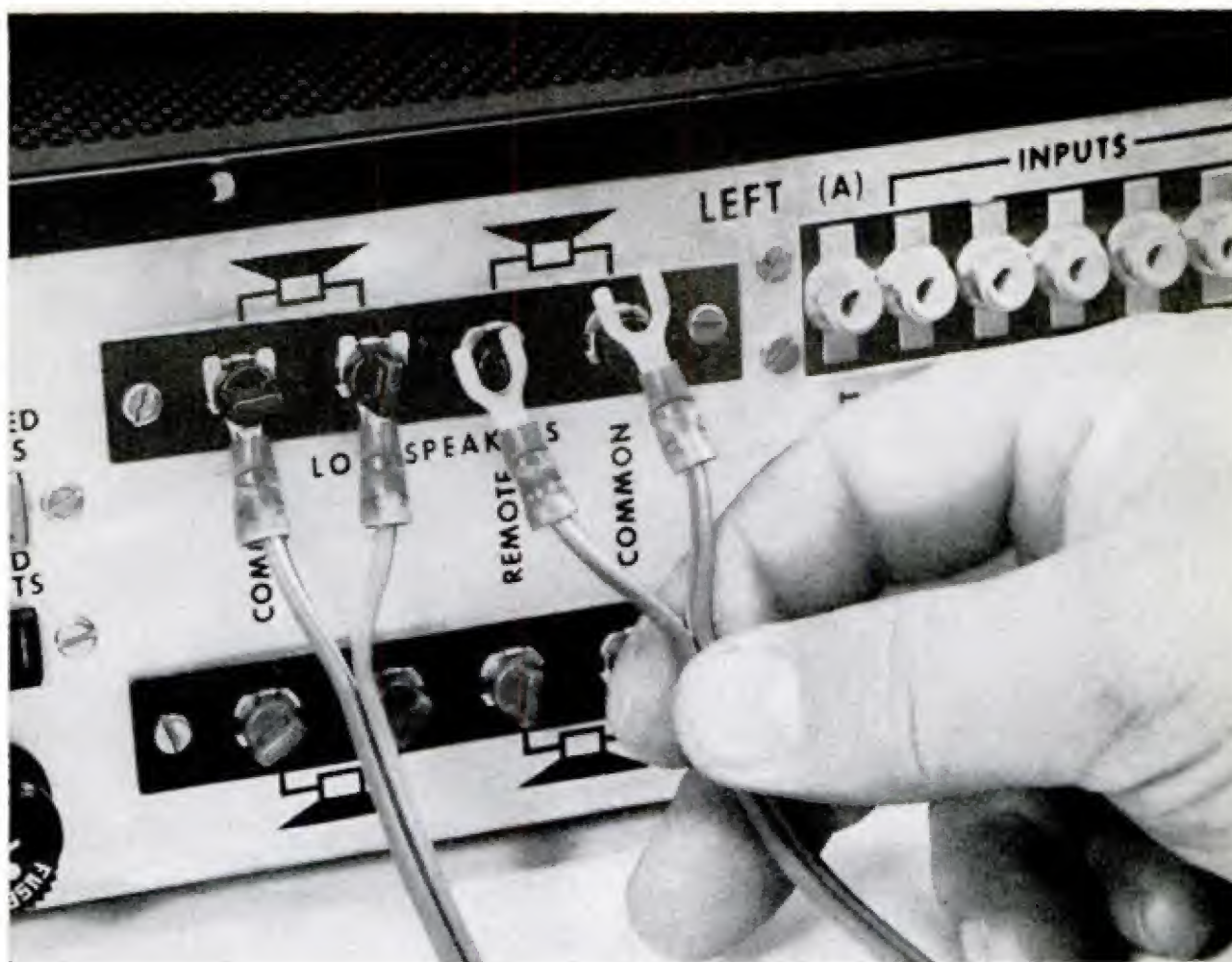
Crimp-on connectors not only save time over soldering, but handle jobs where soldering could be difficult. When working with heavy wire, for instance, the metal draws heat away so fast it's hard to make a good soldered connection with a light-duty iron. Crimped connectors eliminate the problem. They come in a variety of types and sizes. Many have color-coded insulation sleeves for quick identification of wire gauge. Yellow is used for heavy 10 to 12-gauge wire, blue for medium 14 to 16-gauge wire and red for light 18 to 22-gauge wire. Some crimping tools have similarly color-coded crimping notches so you can tell at a glance which notch to use depending on the wire diameter you're working with.

Open-ended spade lugs are good for



TWO TYPICAL CRIMPING TOOLS are Vaco's at top left and Api's Super Champ at bottom. Both handle wire gauges from 10 to 22 and cut and strip ends

POPULAR MECHANICS



SPADE-TYPE CONNECTORS make fast work of attaching speaker or antenna leads to a hi-fi set. Note

double crimp marks—one to lock connector to wire, one to anchor connector's sleeve to the insulation

making quick connections to screw terminals since they can be slipped on or off with only a few turns of a screwdriver. Closed-ended eyes can't pull off accidentally, but take a little longer to install since the screw must be removed completely and inserted through the hole. Spades are best for connections that may be changed frequently, eyes for those likely to be more permanent. There are also several types of end-to-end con-

nectors for splicing wires together. One slip-together fitting is especially useful for wires that must be disconnected often.

Crimping tools all perform basically the same function, but vary slightly in design. Most types cut and strip wire ends in preparation for attaching connectors. In addition to crimping notches for standard wire sizes, some incorporate an extra-large notch for fastening connectors onto heavy auto-ignition cable. If you do a lot

3 types of crimp-on connectors for easy wire splicing



BELL-SHAPED SPLICER at left works like a wire nut except you crimp it on tightly instead of just screwing it on. All you do is twist wires together, slip

on connector and squeeze. At center, slip-together coupling can be quickly disconnected if the need arises. At right is a permanent end-to-end splice



SOME OF MANY CONNECTORS AVAILABLE are shown above. Most common are round eyes, straight end-to-end couplers and slotted spade lugs. At top right is special bent-tip spade lug designed to hook under screwhead so it can't slip off. Below this is auto ignition-cable connector. At lower left: the bell-ended type for joining wires twisted together. At upper center: quick-disconnect slip-fit couplings



HANDY KITS include crimping tool, assorted connectors and instructions in plastic carrying case. This Api Super Champ model is by American Pamcor



BOLT-SHEARING SLOTS are helpful when you don't have right length on hand and can't get to a store. Vaco and Api tools above both cut up to No. 10/24

of car work, this is a good feature to look for. The better models also have bolt-cutting blades that will shear a bolt to exact length—a welcome aid if you need a non-standard size. Special cutting holes handle bolts from 4/40 up to 10/24.

Recommended crimping techniques vary slightly so follow the instructions that come with the particular tool you buy. Some call for a single crimp; others advise a double crimp—one around the bare wire end and a second around the insulating sleeve. Prices range from about \$5 for a tool alone to \$10 for kits that include a tool and assortment of connectors. Some typical makes are Api, sold by American Pamcor, Inc., Box 1776, Paoli, Pa. 19301; Vaco, sold by Vaco Products Co., 510 North Dearborn St., Chicago, Ill. 60610; and Waldom, sold by Lafayette Radio, 111 Jericho Turnpike, Syosset, N.Y. 11791.

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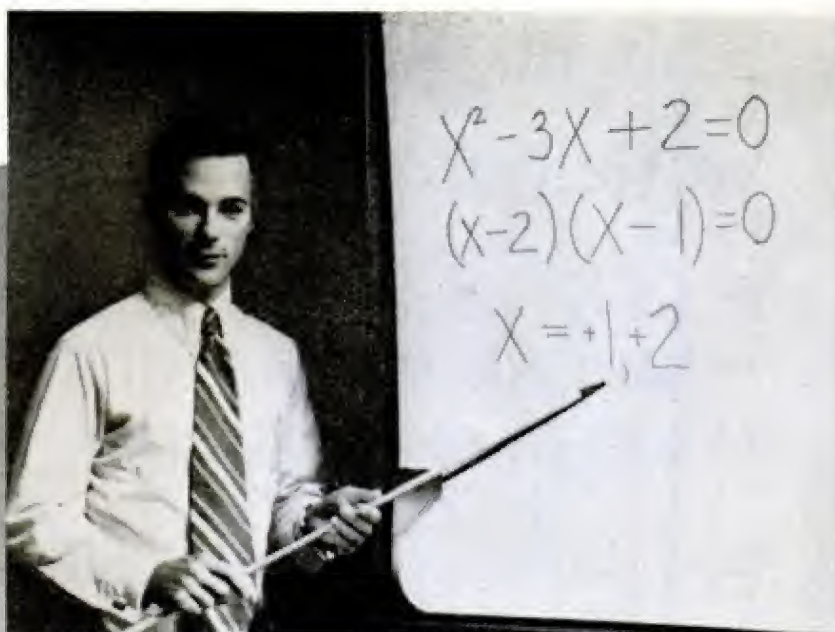
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APRIL 1972

NEW IN ELECTRONICS



SCHOOL WAS NEVER LIKE THIS! Write on the blackboard at left, and it comes out on the "remote blackboard" at right—up to thousands of miles away. Developed by Bell Labs, the system could enable one teacher to in-

struct students in classrooms all over the country or scientists and businessmen to exchange data miles apart. Writing is translated into electrical pulses sent over phone lines, "redrawn" by moving beam of light on film.



WHO SAYS YOU CAN'T EDIT small cassette tapes? While the process takes care, it's possible to pull the tiny tape from the cassette and add or remove sections as desired. To help, two cutting and splicing blocks made especially for cassette tape have been introduced by the Audiotex division of GC Electronics, 400 South Wyman St., Rockford, Ill. 61101. An inexpensive manual-type cutting block (far left) sells for \$2.95. A semiautomatic model of the press-to-cut type (near left) is \$4.95. This version provides both a diagonal blade for making end-to-end cuts and two parallel blades for after-splice edge-trimming.



ELECTRONIC REPELLER at left is said to drive away mosquitos by emitting an inaudible signal the pests can't stand. Operating on batteries, it's effective from three to eight feet and can be clipped to a shirt pocket or worn around neck. Called Skeeter Skat, it's \$9.95. Sports Alliance, Inc., 12016 Wilshire Blvd., Los Angeles, Calif. 90025.

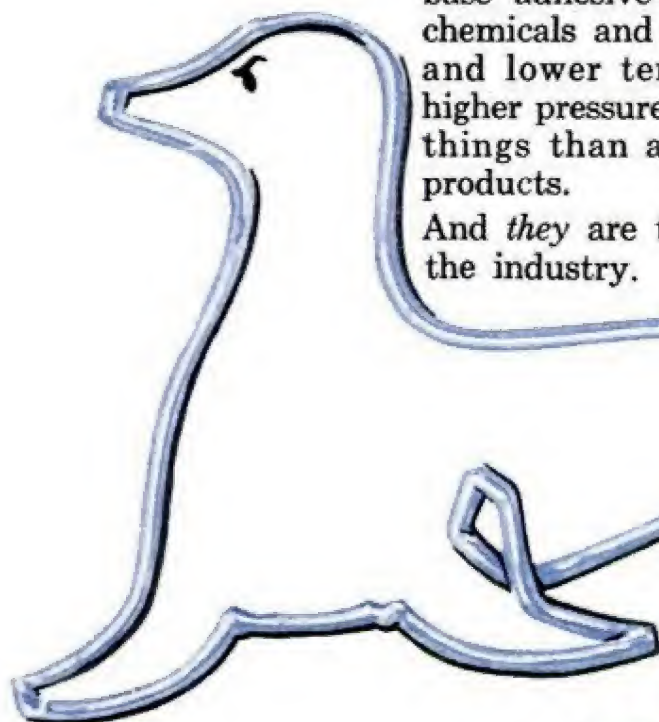
SLIM, STAND-UP MIKE at right, originally sold only with Ampex stereo cassette recorders, is now available as a separate accessory. Only 4½ inches tall, the low-impedance, omnidirectional dynamic design comes with removable "poker chip" base that permits use as hand-held or desktop mike. \$7.95, Ampex Corp., 2201 Estes Ave., Elk Grove Village, Ill. (More New in Electronics on page 184)



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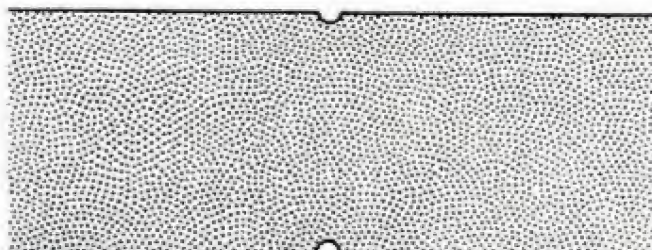


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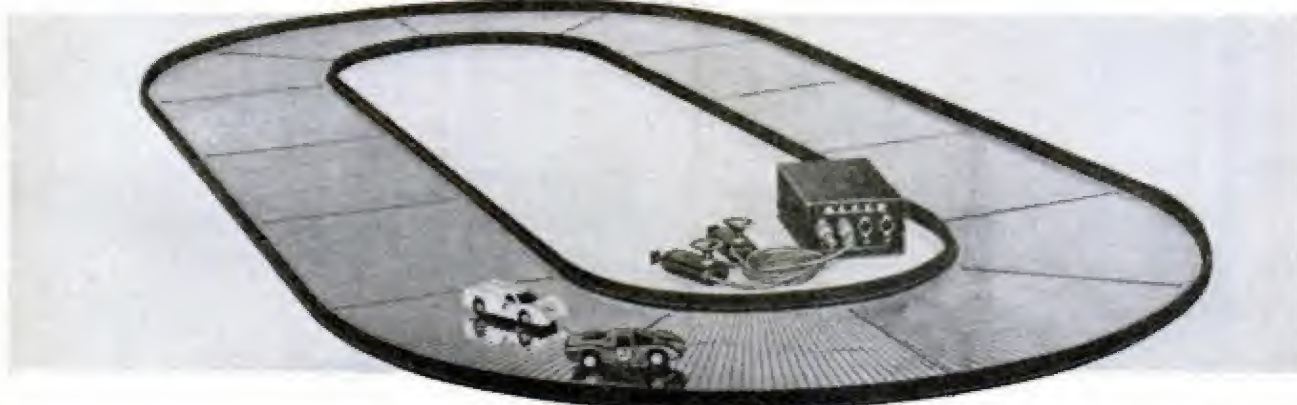
AUTOMATIC SHUTOFF can be added to any tape recorder with this accessory, enabling you to fall asleep or leave the machine without fear of forgetting to turn it off yourself. A motion-sensing device trips a switch the moment a tape stops, shutting off both recorder and other associated equipment such as an amplifier or phonograph. Servo-Matic is \$22.50 as kit, \$35 assembled. Cymax Audio Accessories, 162 Buffalo St., Hamburg, N. Y.

SLOPE-FRONT CLOCK RADIO (right) features AM/FM, digital time readout, automatic post-sleep shutoff, wake-to-music alarm, plus regular buzzer alarm. The RCA set is about \$50.

MORE REALISTIC RACING is the object of this slotless track for 1/32-scale Grand Prix model cars. The unique Heathkit system is based on dual rear-wheel motors that can be independently speeded up or slowed down to permit exciting turns, drifts, stunt maneuvers. Control signals are radioed to tiny receivers in cars. Basic kit includes 4x8-foot oval track, two cars, two controllers for \$129.95. Extra cars, controllers, track are available. Heath Co., Benton Harbor, Mich. 49022.



CONVERTIBLE CARTRIDGE PLAYER lets you listen to your eight-track stereo tapes either at home or in your car. For use on the road, the entire cartridge player unit slides out from the front (lower photo above) and can be slipped into a special under-dash bracket in your car for operation on 12-volt d.c. Model RE-8080 Westminster, made by Panasonic, also incorporates an AM/FM/FM stereo receiver. Price with two speakers is about \$220.



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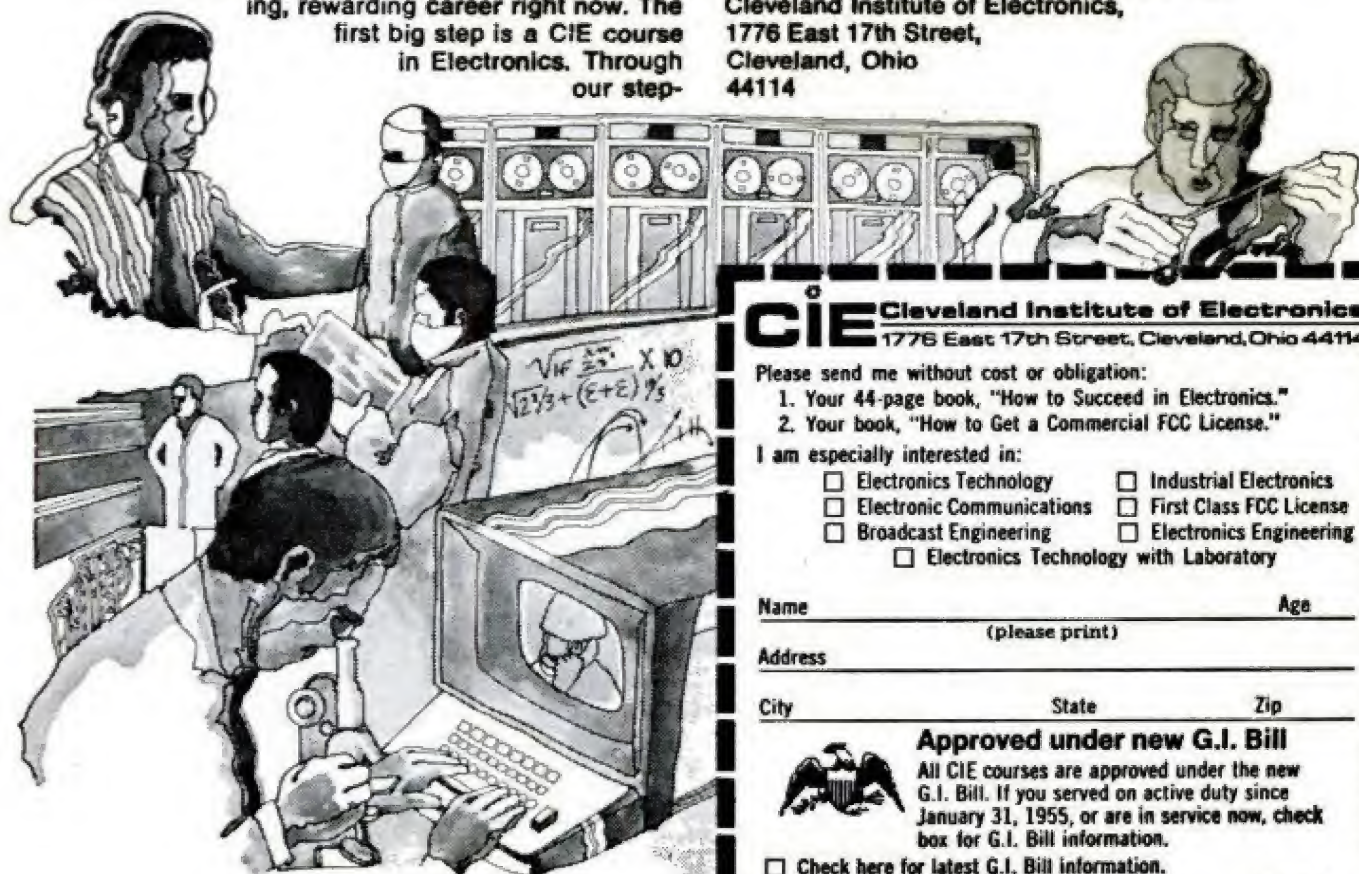
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av. per cigarette, FTC Report Aug '71

Cartridge adapters: Now you can play cassettes and FM, too

By **SHELDON M. GALLAGER**

SO YOU'RE DRIVING ALONG listening to your eight-track tape player, only it isn't playing tape—it's playing FM radio! Manufacturers are finding clever ways to make the ubiquitous car stereo do more than just play eight-track cartridges. Slip in one type of adapter and you can enjoy your favorite cassette tapes on the road as well as at home. Another kind of slide-in adapter serves as a radio tuner, using the cartridge player's amplifier stages to provide AM or FM reception through your existing speaker system. Since stereo cartridge players already incorporate two-channel amplification, you automatically get FM stereo sound whenever such broadcasts are available.

The adapters are shaped like a standard eight-track cartridge and lock into the tape-loading slot in the same way. In most cassette converters, the tape transport mechanism is powered by the pinch roller that normally drives the cartridge tape, although at least one maker uses a separate motor to accomplish the same job. In radio adapters, you'll find differences, too. Most operate directly from the car's 12-volt electrical system, but a few require an additional 9-volt battery. The majority are designed to provide FM reception on the theory that most cars already have an AM radio as standard equip-



JUST SLIP IT IN THE SLOT and this slim adapter pack converts a car-mounted 8-track cartridge player into a cassette player. Cassette's sound plays through amplifier in cartridge unit. Made by Toyo, it's \$29.95



FM MULTIPLEX ADAPTER provides stereo reception in areas where multiplex broadcasts are being made. It has a handy roller-bar tuning knob, is sold by Audiotex for \$54. A similar AM/FM model is available for \$45



CASSETTE ADAPTER by Boman Astrosonix has built-in motor instead of being driven by cartridge player's pinch roller. Priced at about \$22, it has a wide, easy-to-feel-for pushbutton on/off switch across front



ment. For cars not so equipped, you can get a combination AM/FM adapter that provides AM reception along with FM, but usually not with FM stereo.

If you should choose the FM multiplex type, be sure there are multiplex stereo broadcasts in your area. Some such adapters offer only FM multiplex and not regular FM.

Prices range from as little as \$20 to \$50 or more. Some typical makers are Audiotex, GC Electronics, Rockford, Ill. 61101; Hitachi Sales Corp., 48-40 34th St., Long Island City, N. Y. 11101; Toyo Radio Co., 1842-B West 169th St., Gardena, Calif. 90247; Boman Astrosonix, 9426 Stewart and Gray Rd., Downey, Calif. 90241; and Lafayette Radio, 111 Jericho Turnpike, Syosset, N. Y. 11791.

How good are these little adapters? It depends on what you're looking for. At \$30 or \$40, you can't expect glorious living-room-quality stereo. PM tried several units and found them to be adequate for car use. If you take them for what they are and don't ask for miracles, they can be handy, fun to have, and will increase the usefulness of your car stereo at relatively little expense. ★★★

HOW DO YOU ATTACH an FM stereo adapter to your car's antenna without disrupting regular AM reception? Like most others of its kind, this Audiotex model comes with a special Y-type connector cable (top left) that permits both AM and FM radios to be fed from same antenna simultaneously. Male end of connector plugs into antenna socket in AM radio, while female end accepts plug from antenna cable

SLIGHTLY DIFFERENT in design is battery-powered FM stereo adapter below, sold by Lafayette Radio for \$29.95. It requires a separate 9-volt transistor battery housed in a removable clip in the side

SELF-POWERED Hitachi FM stereo adapter couples tuner's output to tape player's amplifier circuits electromagnetically without any direct connection. It works with any 12-volt player, sells for \$49.95



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Aboard a sternwheeler, time drifts back 100 years. And you become part of the unchanging life on the river.

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And you could hardly find a more dependable way to see it than in the Chevy Nova.

Actually, this year's Nova is pretty much unchanged from last year's Nova. The car independent auto mechanics said was "easiest to service" and had the "least mechanical problems."

(Compared to *all* cars, in a survey

conducted by *Motor Service* and *Service Station Management* magazines.)

With a car as dependable as Nova, you don't go redoing it every year.

Mechanical improvements, yes. Like better emission controls. We do what ought to be done, because we want your new Nova to be the best car you ever owned.

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1972 Nova Coupe with the famous Della Queen riverboat.

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SUPERFAST SPY PLANE

(Continued from page 83)

within a matter of minutes the direct line followed by the blackbird at its plus-20 miles altitude was plotted accurately by the men on the ground. It was a straight line for Lop Nor.

MiG fighters scrambled, but they quickly lost the faster blackbird, stalling out at their own maximum ceilings of 62,000 feet. The SR-71 streaked west eight miles higher. In 1966—as today—catching up to the speedy SR-71 was quite impossible.

At Lop Nor, meanwhile, the countdown continued even though defense forces in the area had been alerted. The test had reached the stage where it was too late to halt the complex technical procedures, spy plane or no. Communist Chinese security officials gathered at Lop Nor were also aware of the SAMOS (Satellite and Missile Observation System) satellite orbiting the world and overflying their country. They knew that the SR-71 would

MiG fighters scrambled, but they quickly lost the faster blackbird . . .

take low-level photos while the SAMOS, unmanned and inaccessible 300 miles in space, would photograph the results from the greater distance. And they must have reasoned that at least the world would know that the Peoples Republic of China had a nuclear weapon.

Their eyes shielded by special goggles, the pilot and RSO cruised high overhead awaiting the blast. Suddenly, a blinding light spread across the desert floor, followed by a ring of smoke that pushed skyward with increasing speed. Sensors aboard the SR-71 picked up spreading shock waves and transmitters began telemetering vital data. The telemetry was relayed thousands of miles to another American aircraft over the western Pacific. From there it was transmitted to Guam. Eight minutes after the blast the White House was advised that it had occurred. Five hours later the President received an extensive report saying that this had not been a thermonuclear explosion.

Much of the credit for this intelligence coup belongs to Clarence (Kelly) Johnson, Lockheed's top designer and the creator of the U-2. When that high-flying but slow plane fell victim to improved Russian surface-to-air missiles, Johnson returned to his drawing board. His new design, called the A-11 in the early '60s,

was a relatively light aircraft boasting high-speed performance at very high altitudes and good range. For years, the SR-71 has been the plane. Nothing can match it, not even the Soviet's latest MiG-23 "Foxbat."

Today, the supersecret spy plane regularly flies out of southern Thailand's Takhli airbase, a haven for SAC's B-52s. The blackbirds have flown over Laos and North Vietnam and, since last July, have been peeking across Communist Frontiers into China from 20 miles up.

Along with some extremely sophisticated ferret equipment used to eavesdrop and record what's happening in the communications network of any specific target area, the blackbirds carry digital data systems that process information picked up by the sensors studding the aircraft. One of the most important pieces of equipment on the SR-71 is the SLAR (side looking radar) system that can reach out 60 to 100 miles on each side of the high-flying aircraft and provide the capability to survey 60,000 square miles in an hour.

No wonder the Soviet Union and Communist China have tried to establish spies near the airfields used by the blackbirds.

In another effort to counter the flights of the SR-71, the Soviet Union has set up a "blackbird watch" in the Pacific, using sophisticated electronics aboard "fishing" trawlers. The spy ships, set up to monitor Soviet space shots and ferret out electronic intelligence, also have an early warning-system capability. Radar operators aboard the trawlers have locked in on and marked the high-altitude SR-71s.

The build-up of Soviet missiles in Egypt has been a constant target for the SR-71, which regularly flies over the Suez Canal area doing photographic and electronic surveillance of missile sites. Although the SAM-2 surface-to-air missiles have been unable to catch the SR-71 over North Vietnam because of limited speed and range, the faster SAM-3 models have given the blackbird crews an occasional scare over Egypt.

Until the SR-71 overflights of mainland China were curtailed, the blackbirds had photographed and monitored most of Peking's 11 nuclear tests. But for some months now there has been a gap in intelligence without the SR-71 overflights.

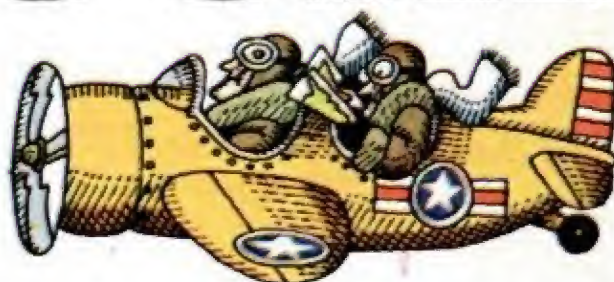
Mainland China has been building entirely new nuclear testing facilities along with missile launching sites in Tibet. SAMOS Satellites provide long-range pictures of the progress, but the Pentagon and the CIA are champing at the bit to resume blackbird overflights. Only the superspy planes can get the detailed information required by our military. ★★

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GIVING IT THE NEW OIL

(Continued from page 93)

the compression stroke, and the detonating engine will run until it melts holes in the top of the piston and literally burns up.

Or sometimes the engine will stop when wrong or excessive oil in the gas turns to carbon that bridges the sparkplug electrode gap. As you fool around, trying to start up again, the carbon may cool or the piece flake off and the engine will kick over, only to stall and run rough again along the way. This, too, can eventually destroy your motor. Changing fouled plugs used to be a routine part of keeping a two-cycle mill operating. To troubleshoot a rough engine meant a plug change first just a few years ago.

New types of plugs and ignition have helped cure part of this problem. Surface-gap sparkplugs with a flat face and central electrode that can spark out in any direc-

... wrong gas-oil mix can cause ring-sticking, scuffed piston skirts, excess smoke and deficient lubrication.

tion are much less likely to get carboned up than those with the conventional gap, and the extra-high-voltage CD ignition that makes them possible can punch through carbon deposits that would have choked an older engine.

But preignition and plug fouling, while serious, are only a few of the problems faulty fuel can generate. In addition to deposits of carbon in the combustion chamber, the wrong gas-oil mix can cause ring-sticking, scuffed piston skirts, excess smoke and deficient lubrication.

What's the answer? One is to use a fuel mixture that contains one of the new outboard (two-cycle) oils with an ashless detergent as part of its blend. Oils with ashless detergents help eliminate preignition and fouling by controlling the physical characteristics of the carbon deposits. Those that remain after ashless detergents are rather soft and the soot could be wiped off with a rag. The deposits left by some metallic detergent oils are hard and glossy and can glow in the combustion chamber causing preignition.

This is why some major outboard motor companies came out with their own outboard-motor oils. To help check for other brands of acceptable oil, look for Boating

Industry Assn. (BIA) certification on the cans.

"In the past there were some absolutely terrible two-cycle oils on the market," one outboard company engineer commented recently. "They were so inconsistent in quality that we were forced into marketing our own once our engines were perfected to a state where we could offer a two-year warranty on them." There was a time, he reported, when their service department's charts and maps of warranty problems would show clusters of complaints. When a lot of pins marked one area on their map, a factory service representative would investigate and find that just about all the owners with problems were using the same brand of local outboard oil. Switching owners to a proper fuel mix using approved oil of the ashless organic detergent type sometimes cut warranty claims to almost nothing.

For an oil to receive BIA certification, samples are submitted by the manufacturer to the BIA manager of engineering, Don Reed. He, in turn assigns the testing to one of several independent laboratories. As a final checkout after analysis, two identical outboards are run for extended periods—one with the new oil sample in the fuel mix and the other with an already-accepted control ingredient. Finally both motors are torn down and 10 areas are examined for wear, scuffing and carbon or varnish build-up. To receive final BIA acceptance for two-cycle watercooled (TC-W) certification, the oil samples must meet or exceed the performance of the control sample.

No oil can function as designed, however, unless it is properly mixed with the gasoline. This is particularly important now that many new engines can use a 50-to-1 gas to oil ratio. The manual that comes with the engine usually specifies putting one gallon of gas in a can, adding the oil, shaking well to disperse and mix the oil with the gas, and then adding the rest of the gas. Too many operators are not this careful after the first few gallons and end up by dumping in the oil to top off the tank, hoping it will mix. Two-cycle lawn mower and chain saws often get enough agitation while being operated to tolerate this treatment. But high-performance outboard and snowmobile motors can be damaged and a marina refueling man, particularly, may never have been properly instructed and will resent it when you give instructions about the way you want your gas and oil poured in.

Yet improper mix may stratify your gas and oil—you run at a 1-to-1 mixture for a few minutes and then at 400-to-1 for a

(Please turn to page 198)

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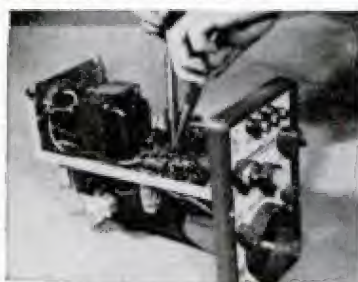
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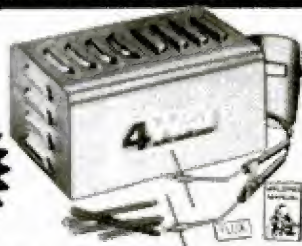
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GIVING IT THE NEW OIL

(Continued from page 194)

while. Predilutants now added to all approved two-cycle oils help speed the mix during cold weather, particularly for snowmobiles. But if you continue to re-fuel by dumping in a full container of oil and then topping off the tank when there is already a gallon or so of fuel in it, as many people do, before long you have too rich a mixture and a cloud of smoke trailing behind your rig.

Sticking piston rings that result from an over-rich mixture can cause reduced heat transfer, reduction in blow-by control, poor idling and a buildup of varnish and carbon on the piston skirts and the chance of increased piston scuffing. Too lean a mix may cause marginal lubrication and severe wear of the cylinder wall in the port bridge area, piston scuffing and bearing failure. Internal corrosion of the outboard is also more likely to occur, particularly around salt water.

The only possible disadvantage of using approved two-cycle oil is its extra cost—perhaps \$5 a season. That seems like a small price to pay to protect your expensive engine. ★★★

POWER ROOF VENTILATOR

(Continued from page 141)

is installed. It should be mounted close to the center of the roof and near the roof ridgeline. Keep in mind that for a neat-looking installation, the unit should be visible only from one side of the roof. This will require the unit to be moved down from the ridge line until it can't be seen from the street. Just how much it must be moved will depend on the slope or pitch of the roof.

When you have the hole cut in the roof, the ventilator is installed in the following manner: With the unit parallel to the ridgeline of the roof, slide the plastic flange up under the shingles, starting at the center of the hole. Position the unit squarely with the 27³/₈-in. outline you marked on the roof and align it with the shingle lines. Continue to slide the flange under the shingles until the round fan housing can be centered and placed in the hole. Now nail the exposed portion of the flange to the roof using galvanized roofing nails. Finally, check for water leakage with a garden hose. The unit should not leak but if it does, use butyl rubber caulking along the edges of the flange. Screw the control box to an attic rafter and follow the diagram provided to connect the 110-v. line. ★★★

COOLING SYSTEM CHECKS

(Continued from page 165)

ample, the engine-coolant temperature-sensing switch closes at 248° F. plus or minus 2°, which will switch on the warning light. If the radiator pressure cap is left loose and the strength of the coolant is at minus 20° F., the coolant will begin to boil at 224° F., which is 24° below the temperature at which the warning light will come on!

● Pure water is not recommended as a coolant. Use a good quality ethylene glycol antifreeze, because it contains rust inhibitors and water pump lubricant.

● Problems other than cooling-system trouble can cause overheating—primarily, incorrect ignition timing and dragging brakes.

● Air or combustion gas entrained in the cooling system can raise the level in the radiator and cause loss of coolant through the overflow tube. Air can be drawn into the cooling system through a leak at the water-pump seal. Gas can be forced into the cooling system through a leak at the cylinder-head gasket.

A quick check you can make to see if this is happening involves starting with a cold engine and making sure that the coolant is to the proper level. Get a plain ordinary *nonpressure* radiator cap and make sure it's on tight. Disconnect the overflow tube, which you'll find attached to the side of the radiator filler neck and extending downward along the side of the radiator.

Run the engine at a constant high idle speed until it reaches operating temperature. Without changing engine speed, place the free end of the tube into a jar of water. Make sure the tube is not bent or kinked.

If bubbles appear in the water, air is being sucked into the cooling system or exhaust gas is leaking into the system past the cylinder-head gasket.

● When you drain a cooling system, make sure that you remove all of the old coolant. Drain the block as well as the radiator.

● If you added Stop Leak to the cooling system, the presence of oil in the coolant shouldn't be cause for concern. Stop leak has an oil-soluble base. Naturally, engine or transmission oil found in the coolant is another matter. In the case of engine oil, that trouble might be a blown head gasket. In the case of transmission oil, the problem is probably a ruptured transmission oil cooler which, in a majority of cars, is actually an integral part of the radiator.

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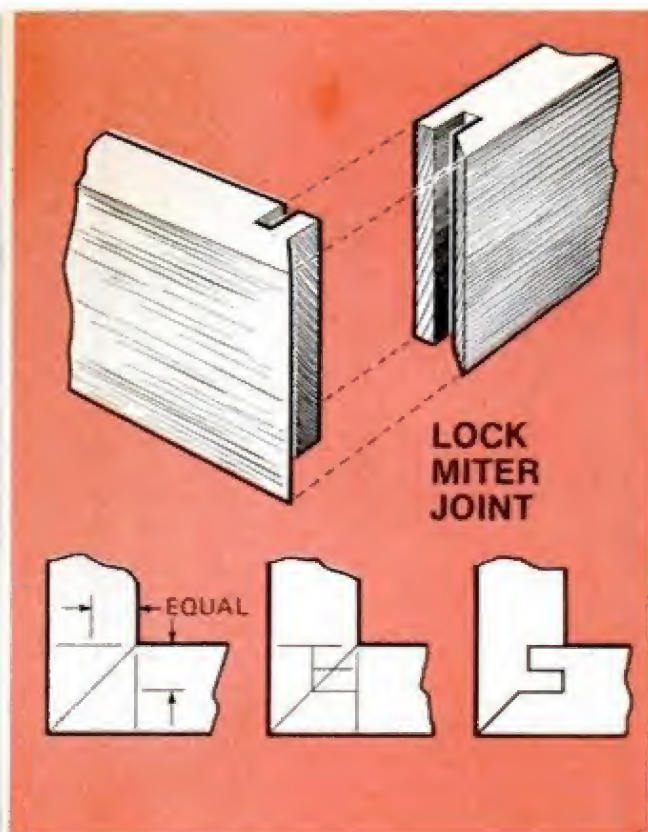
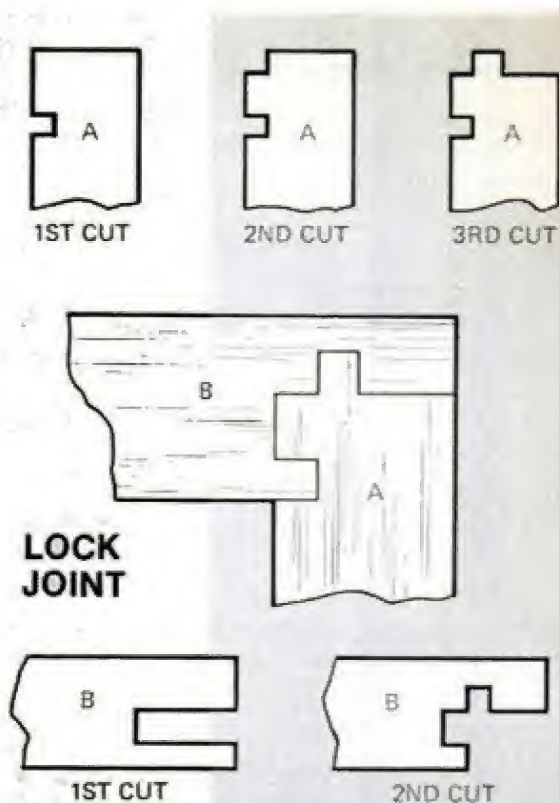
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WOOD JOINERY

(Continued from page 159)

made after the shoulder cuts, and general practice in making a simple mortise-and-tenon joint is to cut the tenon first, then the mortise. While the tenon can be formed on the table saw, the mortise has to be cut with a mortising chisel on the drill press. An exception would be an open-end mortise.

Another table-saw jig for cutting perfect box, or finger, joints is detailed at the top of page 159. Similar to the dovetail joint, the box joint makes a neat-looking corner joint and is exceptionally

strong since it presents lots of gluing surfaces. To make the jig, you start with a $\frac{3}{4}$ -in. wood auxiliary fence, which is screw-fastened to the miter gauge. Then the regular saw blade is removed and replaced with a dado blade. In most cases, the width of the cut is equal to or slightly less than the thickness of the stock, and likewise when determining the depth. Make initial cut (A) in the wood fence, then remove it from the miter gauge.

Mark the position of a second cut (B) so it is spaced the same width as cut A and at the same time mark lines C and D, centering them as shown. Nail a

(Please turn to page 202)

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VACATION HOME ROUNDUP: YEAR-ROUND CASUAL LIVING. Today's second-home owners want more than just a shack in the woods to escape to. The hustle and bustle of urban living makes it more desirable than ever to have a home in the country or by the sea that you can use for long weekends, sea or ski vacationing or year round. Four elegant homes featured in PM's annual vacation-home roundup include a contemporary by the sea, easy-to-build A-frame, a chalet-type and a modern home that leave nothing to be desired.

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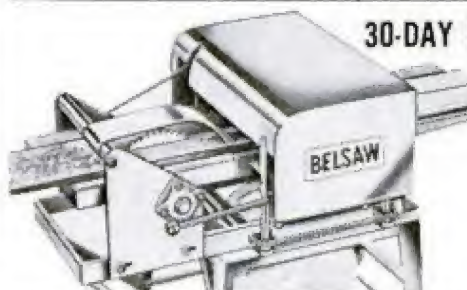
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WOOD JOINERY

(Continued from page 200)

little square of wood 2 in. long in cut A to provide a guide pin and finally attach the wood fence to the miter gauge and make cut B. You are now ready to make the box joint.

Mating pieces of stock are set against the fence, the edge of one piece being set even with line D and the edge of the second piece even with line C. Now pass the offset work across the saw. To make the second cut, as well as the third and succeeding cuts, shift the work so that the cut just made sits over the guide pin and again pass the work across the saw. Repeat the operation along the entire width of the stock. ★★★

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FIXED-LENS CAMERA LENSES!

(Continued from page 99)

number, the greater the magnification. Used in Series-type screw-in or slip-on mounts, such supplementary lenses can be fitted to just about any camera lens. Focusing is done by careful measuring since there's no way of seeing the subject through the attachment itself on most fixed-lens cameras. Handy focusing tables come with each lens to guide you.

Series-type close-up lenses are sold by Kodak, Spiratone and other makers. To determine the size you need, take your camera to a photo dealer and have him fit the lens to it, using the appropriate adapter ring. Prices are about \$2 to \$10, depending on power. Kalimar also offers its telephoto and wide-angle attachments in Series-type mounts in the event that one of its regular mount sizes will not fit your particular camera. These sell for about \$25 to \$45 in sets.

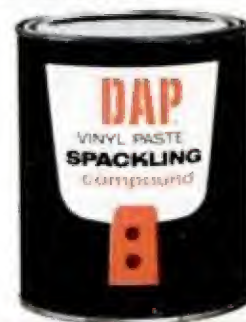
Spiratone's Plus-20 Macrostigmat is a powerful close-up attachment that provides big frame-filling 1 to 1 images, making it ideal for shooting tiny objects. With an accessory slide duplicator, it can be used to copy favorite 35-mm color transparencies. Its price is \$14.95. Spiratone

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also offers matched pairs of telephoto and wide-angle attachments for twin-lens reflexes. They're \$19.95 each or \$35.95 a pair.

Vivitar, another big maker of accessories, provides close-up lenses for both twin-lens reflexes and single-lens reflexes. They range in power from Plus-1 to Plus-3 and come in either threaded or bayonet mounts to fit particular lenses. Prices are about \$8 to \$25. There's also a Plus-10 Macro Adapter and a Series VII Plus-1 to Plus-10 variable-power close-up accessory. The Macro Adapter sells for \$7.50 to \$9.50; the variable lens for \$27. All of these accessories are, however, designed for reflex-type cameras where focusing can be done through the lens. Kodak also offers special close-up attachments for its Instamatic Reflex—again for through-the-lens focusing.

Vivitar accessories are sold by Ponder & Best, Inc., 11201 West Pico Blvd., Los Angeles, Calif. 90064. Rolleiflex attachments are marketed by Honeywell Photo Products, Littleton, Colo. 80120. Other makers are Kalimar, Inc., 2644 Michigan Ave., St. Louis, Mo. 63118; Polaroid Corp., Cambridge, Mass. 02139; Spiratone, Inc., 135-06 Northern Blvd., Flushing, N.Y. 11354; and Eastman Kodak Co., Rochester, N.Y. 14650. ★★★

'72 ROAD RACING PREVIEW

(Continued from page 79)

States Grand Prix in California this month are landmarks in America's road-racing history, but the Can-Am and the GP races are only the more spectacular events in a full schedule of road racing across the country featuring all types of cars.

Sedan racing, for example, is one of the most exciting forms of road racing American-style, and it started long before the SCCA set up the Trans-Am Championship. (Would you believe that Dan Gurney ran an *Impala* in England specifically to challenge the dominance of the noble Jaguar? Well, he did! In the early 1960s.)

The Trans-Am series, always a manufacturers' award, will add a drivers' championship this year. With Donohue and Penske busy on the Can-Am trail and campaigning an American Motors Matador in the NASCAR Grand Nationals, defense of the Javelin title will be in the hands of veteran George Follmer who is likely to make it two years in a row for AMC, and a new title for himself.

Road-racing sedans can be seen virtually any weekend of the season: There's the Trans-Am and the Two-Five for 2.5-liter cars, and the heavy schedule of SCCA club racing throughout the country; NASCAR runs the Grand American series for pony cars and the International Motor Sports Assn., which sanctions sports sedans, subcompacts and stock-sedan "baby grands," has an expanded schedule for '72.

In the Datsun 510, John Morton will be defending the 2.5 title, and the series this year should have the added excitement of Pintos in competition, maybe a Vega, and hopefully, later this season, the entry of Toyota and the rotary-engined Mazda.

Sedans of every shape and size participate in the popular, locally organized,



SCOTT HARVEY winning the 23rd annual Press On Regardless Rally in Plymouth Cricket. The 1500-mile European-type rally is in Michigan in November

American-style rallies. They're exercises in precision driving through city or countryside, on a route that's undisclosed until the driver and his navigator are under way. Interesting, but not "racing." European-type rallying, on the other hand, is an all-out race over a minimum 1200 miles in all kinds of weather on all kinds of roads—a real test for cars and drivers. The United States' only real rally of this type is the Press On Regardless International Rally that runs in Northern Michigan in November. It's on the calendar of the Federation Internationale de l'Automobile (the world governing body for motor sports) and this year the event will be included in the World Rally Championship which includes such grueling events as the Rallye Monte Carlo and the East African Safari.

Another world series, the Manufacturers Championship for sports cars, prototypes and grand touring cars, visits the United States several times with races at Daytona, Sebring and Watkins Glen. Mario Andretti and Jackie Ickx won the six-hour endurance race at Daytona in February in a Ferrari. The Sebring event runs a few days before this issue goes on the newsstands, and the Watkins Glen rolls July 23rd. This year's new three-liter limit leaves Alfa Romeo the only competition for Ferrari, since three-year-winner Porsche has taken its big-displacement blocks and gone Can-Am.

Open-wheel Formula racing in the United States includes Formula Ford, Formula Vee, Super Vee, Formula B and, for the big-bore, five-liter machines, Formula 5000, formerly FA. 1972 promises to be an intensely competitive year in F5000 with last year's champ, David Hobbs, due for lots of competition from the likes of Sam Posey and George Follmer.

Road-racing competition: dangerous dicing and lots of dropouts. A two-lane blacktop with only one winner. The '72 season is under way! ★ ★ ★



PETE CONRAD, Apollo 12 commander, is a moon-walker and race driver. He's campaigning Formula Super Vee Lola in road races during the '72 season



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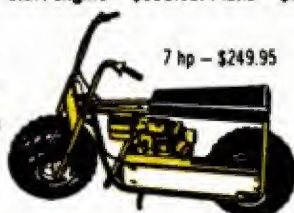
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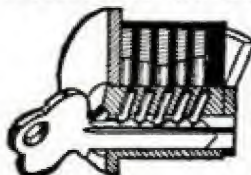
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As in many other formerly inaccessible areas of the world, helicopters are making it possible to carry cargo to hard-to-reach spots in the Austrian Alps. Here an Austrian Air Force copter brings in equipment for a TV-relay station being built 8200 feet up in the mountains near the town of Zurs. Trucks were unable to reach the site.



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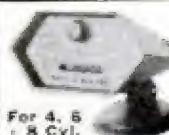
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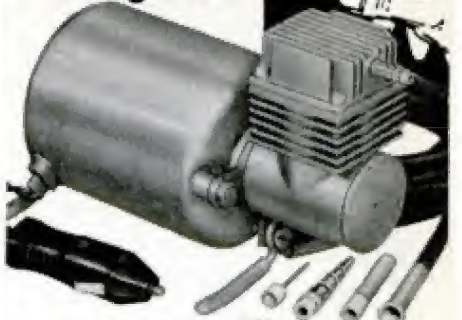
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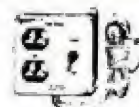
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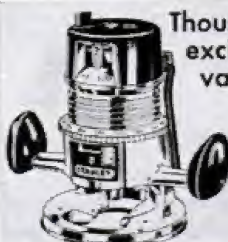
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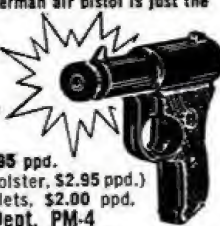
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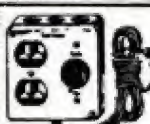
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(Continued from preceding page)

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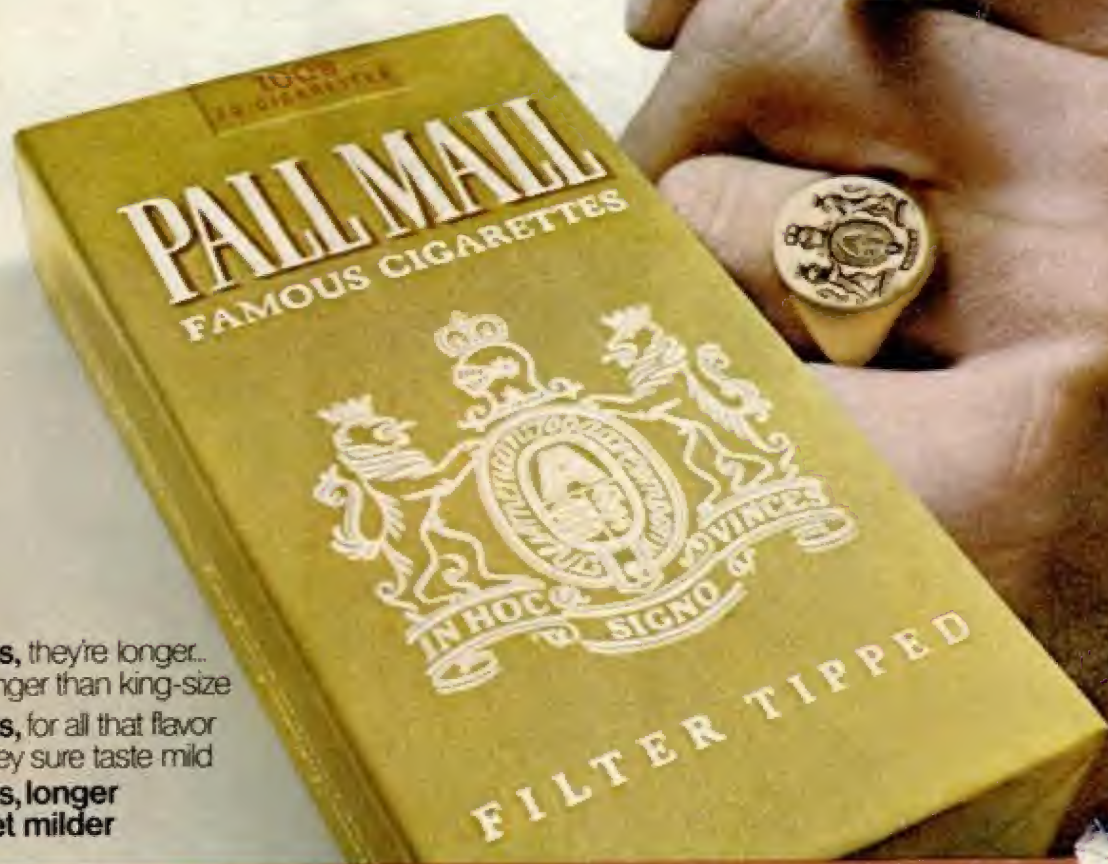
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